The Dock and Harbour Authority

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Editorial

The Port of Tangier.

At the entrance to the Mediterranean, and within a few hours' sail of Gibraltar, the Port of Tangier occupies a strategic position of importance, both commercially and politically, and the zone in which it is located, originally part of Moorish territory, and under Cherifian rule, has been inter-nationalised. The port itself comes under the administration of a Commission on which the four countries of Great Britain, France, Spain and Italy are represented. Under this body, the harbour is being enterprisingly developed and improved, and through the courtesy of Monsieur Fayard, the Engineer-in-Charge, we are able to present in this issue an account of the measures adopted, with an illustrated supplement, showing the lay-out of the harbour and the design of the breakwater.

We recall a visit to Tangier a few years back, when we had an opportunity of seeing the work in hand under the able direction of M. Fayard. At the time of our visit, however, operations were temporarily suspended for financial reasons, and the breakwater had only reached a point little more than a moiety of the total length contemplated, and judged necessary for full protection of the harbour. It will be seen from M. Fayard's article that the completion of the undertaking still remains to be realised, and that future policy is likely to be influenced by the views which are taken by the Administration on the prospects of the port. It is interesting to note that there is an important development of passenger traffic, a point which we observed at the time. Tangier has a number of attractions to offer the holiday visitor, with its pleasant up-to-date town and beach, in close proximity to the old quarter, where Moorish inhabitants maintain the customs and dress of by-gone ages. As regard the latter area, our impressions were not altogether favourable. Despite the interest inevitably aroused by the strange, oriental, age-old environment, the offensive smells and the dust, coupled with the heat of the sun in narrow stifling courts and alley-ways, made us apprehensive of insanitation and infection, and a short circuit of the quarter, beset by importunate and voluble beggars (chiefly youngsters) sufficed for our satisfaction. Needless to say, in the European district the conditions are totally different, and the view of the bay was most pleasing and attractive.

The Port of London Authority.

The Paper read by Sir David Owen before the London School of Economics, and reproduced in this issue, is an interesting survey of the responsibilities and functions of the Port of London Authority, which has now been in existence for more than a quarter of a century. The record of its history, chequered though it has been in the past, is gratifying to the citizens of the Metropolis and creditable to those to whom, since 1909, has been entrusted the welfare and destiny of a great seaport. Out of the chaotic activities of a variety of conflicting interests the port has been welded into a substantial and coherent entity, working smoothly and efficiently and moving with the times to secure for London its due share of overseas trade, and to maintain its place in the world of commerce. As will be noted, since 1909, both the shipping trade and the goods traffic have increased by about 60 per cent. Londoners will do well to take pride in the development of their port and to study the wide ramifications of its influence and achievements. Its shipping links it with the furthest quarters of the globe, and it levies tribute on the produce of the most diverse climes and territories. With such a proud heritage, it is reassuring to feel that the administration of the port is being carried on by capable and energetic hands.

Pool of London Improvements.

The passage through Parliament of the City of London (Various Powers) Bill is a reminder that even in its own domain the Port of London Authority is not quite in complete control. At the time of the constitution of the Authority in 1909, the rights and privileges of riverside wharfingers were exempted from the Authority's jurisdiction, and except in so far as regards licensing embankments and any works below high water mark, and laying down frontage lines, the Authority do not exercise administrative functions along the riverside, at any rate within the city boundaries. The City Corporation are the owners of Billingsgate Market, and in order to provide additional space they are seeking to acquire the riverside properties lying between the Market and the Eastern boundary of Fresh Wharf, together with certain other properties in Lower Thames Street. On this site they propose to construct a new quay linking up new Fresh Wharf with Custom House Quay. The Bill gives the Corporation direct statutory powers to carry out this work, and in connection therewith to "construct place and maintain in the River Thames and the beds, banks, shores and channels thereof all such piles, fenders, booms, dolphins, caissons, stagings, cofferdams, embankments, piers, abutments, wharves, walls . . . . and other works as they may deem expedient or necessary." The Authority's attitude is one of tacit acquiescence but, in the following clause, the written consent of the Authority has to be obtained if the Corporation wish to "dredge, deepen, scour, cleanse, improve, alter and interfere with the bed, banks, shores and channels" of the river. The situation is interesting as illustrating the maintenance of private interests in the port, and the exemption from interference within limits, and in so far as wharfage rights are concerned, of an extensive river frontage. The new quay, when constructed, will be an important improvement, and will add to the appearance and prestige of the "Pool of London," to which the recently completed concrete quay at New Fresh Wharf has already contributed an effective and useful feature.

Baltic Harbours.

It is only within recent years that Poland has succeeded in obtaining a seaboard for the development of her external commerce, and during this time the Port of Gdynia has sprung into existence, and forms, with the neighbouring Port of Danzig, the northern and only outlet for Polish commerce abroad. Of the two ports, one is extremely modern, while the other is of mediæval origin. Mr. Nagorski, who is Managing Director of the Administration of the Port of Danzig, discusses in the paper on page 250, reprinted from the Bulletin of the International Association of Navigation Congresses, the suitable dimensions, as regards draught of water and harbour entrance widths, for the ports in the Baltic, having more particularly in view the two Polish ports mentioned above.

From this paper it would appear that, with the exception of Gdynia, a depth of 33-ft. in the harbour and entrance channel, as also alongside the quays, suffices for all present requirements. The Port of Gdynia, being a new modern creation which, it will be remembered, formed the subject of an article in this Journal in January, 1936, has depths approaching 39 to 40-ft., with a view to meeting the standard of future developments in shipbuilding. The conclusions of Mr. Nagorski are, of course, only intended to apply to the conditions prevailing in the Baltic, but his arguments are of importance to those concerned with port development, and as such will be read with interest and advantage.

Editorial—continued

The Thames Barrage Proposal.

The debate in the House of Lords on May 27th, a report of which, not available in time for our June issue, is to be found on page 244 of the current number, brings again into prominence a scheme which was publicly propounded some few years ago by Mr. J. H. O. Bunge, and has since been the subject of active propaganda and advocacy by the organisation known as the Thames Barrage Association. It is a scheme of a grandiose character, involving a complete change of regimen in the lower Thames by excluding tidal action from the whole of the river above Woolwich, where it is proposed to construct a barrage, or dam, which would impound the water up-stream at practically constant level.

The advantages of the proposal, as viewed and set out by the promoters, are various, and somewhat too numerous for detailed consideration in these columns. The main argument appears to be that while the Thames in its upper reaches is a "lovely little river, with beautiful shores and wooded hills," the amenities and salubrity of the waterway in its passage through London are destroyed by the "sinister influences" of the tides. A leading point is made of the fact that the sewage effluent from the Barking and Crossness outfalls of the London County Council main drainage system oscillates up and down the lower river with the daily flux and reflux of tidal action. There is, of course, a not unreasonable substratum of truth in this contention, for the pollution of the Thames, despite the attention given to the matter by the authorities concerned, is admittedly too great to be satisfactory, and any measure which would have the effect of reducing it would be welcomed on all sides. But it is scarcely justifiable to claim that a barrage at Woolwich would provide a complete remedy for the evil. It might possibly remove the leading cause, but it has to be borne in mind that there are a number of sewage-tainted influents which enter the river at various points along its course and the transformation of the Thames into a clear, placid stream, would require more drastic treatment than the construction of a barrage. Moreover, there is the possibility, one might go so far as to urge, the likelihood, of greater intensity of pollution in the immediate neighbourhood of the populous borough of Woolwich, just below the site of the proposed barrage, where the tidal inflow, arrested in its course, would be disposed to deposit its suspended matter in the relatively quiescent area there provided.

Whatever may be the judgment of competent authorities on these features affecting public health and the amenities of the river for residents within the Metropolitan area, it lies more within our province to discuss the effects of the proposal on London as a port and as the centre of a great movement of maritime commerce. And in this respect we are faced with a consideration of the highest importance. London, if not the premier port of the world, is at any rate in the very forefront of the world's maritime gateways, and nothing must be allowed to detract from the pre-eminent position which it has achieved through years of unremitting effort in trade expansion and port development. In point of fact, maritime commerce is the life-blood of this country, and the Thames one of its main arteries. The effect of a barrage across the navigable channel would be to create an obstruction to freedom of movement, which is bound to have objectionable repercussions in various directions. Lord Ritchie, Chairman of the Port of London Authority, has stated that the present incomings and outgoings of shipping, passing Woolwich, number 43,000 annually, with 463,000 other craft of one kind and another. To interfere in the least degree with the manœuvring of this gigantic fleet, or to retard its movements, would inevitably produce congestion and confusion in such circumstances as prevail in a crowded river. The substitution of a system of locks in the main channel for the present open fairway, even supposing the locks to be capable of coping with the traffic, must entail delay and be a constant source of inconvenience. But the capacity of the locks is seriously open to question. The number suggested by the promoters is six, but these, for reasons which need not be particularised here, could not all be counted upon for service, especially with large vessels; Lord Ritchie had no hesitation in pronouncing it to be a physical impossibility to handle the traffic under such limitations. pointing out that ships cannot be scheduled to run to times like trains, and that such characteristic features of Thames estuary experience as fog and bad weather, are bound to produce dislocation of time tables. Moreover, even if ships could arrive to expectation, the operations of manœuvring in and out of the lock chambers, coupled with alternations of direction and the filling and emptying of the chambers, would be most fruitful of delay, and delay is inimical to the economical interests of the shipowner. It can, of course, be pointed out that shipping is at present compelled to enter the docks of the port through lock systems, but this is by no means the invariable rule. Many ships and craft—perhaps almost a moiety of the total—berth at wharves at the riverside where no such restriction prevails.

It would be possible to mention other objectionable features of the proposal, but we have said enough to show that it is anything but satisfactory from a shipping and port point of view. It is significant that there is an entire absence of support for the scheme from any responsible body of shipping and commercial interests. Indeed, as a final remark, we may ask at whose expense the undertaking is to be financed. Four and a half millions is the estimated cost, and we are dubious about the sufficiency of the amount. In view of what has been said, it can hardly be expected that the Port Authority would accept this outlay, or any appreciable portion of it, as a charge on their resources. The dues of the port, in comparison with Continental standards, are at such a level that any increase would act most detrimentally to its interests.

We understand, from an announcement of the Port Authority, that it has been decided by them to hold a public enquiry into the whole matter at a convenient date. This being so, there will be the fullest opportunity of considering the proposal in all its bearings, with the aid of expert evidence on the various points at issue.

The American Association of Port Authorities.

The review of the activities of the above Association through a period of a quarter of a century, which is to be found in this issue, will serve to kindle, or perhaps revive, interest in an American organisation akin to the Dock and Harbour Authorities Association of this country. But while the designations are similar, the scope of the functions of the two bodies presents points of difference. The English Association is, to all intents and purposes, a defensive alliance for the protection of the legal and commercial interests of its members, and it deals almost entirely with parliamentary and legal questions. The American Association, on the other hand, covers a wider field in the reading and discussion of papers on matters of port administration and in considering various aspects of port affairs which affect problems of administration and operation. There are advantages in this ventilation of views on general topics which prompt the suggestion that the purview of the English Association might well be extended to cover a wider field. Several important principles have been established for the systematic treatment of common practice at American ports. A code of fire prevention measures has been adopted. Regulations regarding the conveyance of harzardous cargoes have been secured from the United States Congress. An Ethics Committee has evolved a series of canons to govern the attitude of port officials in the conduct of public affairs. But over and above these instances of the specific crystallisation of ideas, there has been the widespread dissemination of information in a variety of papers on port practice in various localities, which are bound to have been suggestive and helpful to the members.

We had the privilege of attending, by invitation, one of the conventions of the Association in Toronto in 1922, and enjoyed the atmosphere of friendly hospitality and congenial fellowship which characterised the series of meetings and visits of inspection extending over several days. These personal contacts with members and officials of other bodies and a discussion of their special problems are undoubtedly of service in promoting a wider outlook and a field for co-operation.

North Sea Ports.

An article in a recent issue of the Scandinavian Shipping Gazette calls attention to the revival of international trade which is exhibited in the traffic increases of four leading continental North Sea ports. The total goods traffic, i.e., imports and exports, has been steadily growing for the past three or four years, and in the returns for the first quarter of 1937, compared with that of 1936, Rotterdam registers an increase of 16 per cent., Hamburg 9 per cent., Bremen 8½ per cent., while Antwerp has a more modest increment of 1½ per cent. This, as far as it goes, is satisfactory, for general prosperity is very desirable, and Great Britain cannot expect to realise permanent recovery from the period of economical depression unless and until the recovery is shared by other nationalities. It is to be hoped that British ports will be able to maintain and increase the lead which they have so far obtained, and that there will be an all-round return to prosperous conditions in the near future.

Southern Railway Appointment.

Congratulations are extended to Lieut.-Col. Gilbert Savil Szlumper, M.Inst.T., on his appointment as General Manager of the Southern Railway in succession to Sir Herbert Walker. It will be recalled that, prior to being Assistant to Sir Herbert Walker at Waterloo, Col. Szlumper was for some time Docks and Marine Manager at Southampton.

Erratum.—In the table of docks and basins at Calais on page 211 of last month's issue, the letters H.W. at the head of columns 3 and 4 should be deleted.

The Port of Tangier

An International Harbour

By Mr. ANTOINE FAYARD, Engineer of State Public Works for the Zone of Tangier

(Translated from the French)

The Basin for Small Craft.

1. Position: Sea Conditions

THE Port of Tangier is situated at the western extremity of a roadstead considerably exposed towards the north and north-west, and extending between the town and Malabata Point, over a distance of about five kilometres (rather more than three miles).

The prevailing winds oscillate between north-east and easterly, the region of greatest frequency being in the north-easterly direction. The velocity sometimes exceeds 80 kilometres (50 miles) per hour.

South-westerly winds, which are the stormiest in the Atlantic Ocean, are moderated in a certain degree by the hills which encircle the bay, their effect being appreciably reduced in the innermost part of the port near the root of the works.

The north-easterly and easterly winds produce in the roadstead a strong swell, intensified by reflection from the Coast of Spain of the same phenomenon in the Mediterranean. The result is a troubled sea, with irregular waves, of which the height, in the vicinity of the works, does not generally exceed two metres (6½-ft.).

South-westerly gales in the ocean are only feebly deflected to the port after pivotting round Cape Spartel. On the other hand, the great waves from the west and the north-west are comparatively less reduced, the direction of onset being sensibly north-westerly. The height of the waves is as much as four metres in a real Atlantic swell.

The range of spring tides is 2 metres 40 (say 8-ft.).

2. Depths

The sea floor slopes rapidly. In the centre of the bay the 10-metre contour is reached at about 400 metres from the shore line. In the neighbourhood of the works, the rocky bottom consists of sandstone, in a rather thin bed, overlying Schist. In the roadstead soundings reveal a bottom of sand, or gravel.

3. Regimen and Construction of Harbour

The Port of Tangier is a concession by the Cherifian Government to an International Company, on which are, notably, representatives of France, Great Britain, Spain and Italy. The head office is at 41, rue Cambon, Paris.

The development works were assigned, in 1924, to the Société National des Travaux Publics, a Franco-Belgian concern. Control is exercised under the supervision of a Special Commission by an engineer belonging to the International Administration of the Zone.

4. Programme of Works

The scheme of the concession comprises in the first place, the construction of a breakwater, 700 metres in length, with a terminal return and various internal adjuncts. The original estimate was 31 million francs.

The scheme underwent important modification at the time of its practical inauguration, and the sum required was raised from 31 to 73 millions.

The actual programme was as follows:—

(a) Construction of a barge or lighter basin, six hectares (14¾ acres) in extent, with various internal features (quay, reclamation).

(b) Construction of a jetty, 1,020 metres (1,115 yards) in length, exclusive of a shore attachment of 340 metres (370 yards). Construction of a quay with a length of 136 metres, flanking the jetty between the points P.M. 664 and 800, with an access roadway, extra in width to the platform of the jetty. The quay, rising from depths of 10 to 11 metres below zero datum is founded on a bed of quarry fragments levelled at nine metres below datum.

Titan Crane setting Blocks on Breakwater.

(c) Dredging of the rocky shoals in the anchorage area down to — 9.20 metres as a minimum. The quantity removed by the contractors (Messrs. Ackermans and Van Haaren) amounted to 23,000 cu. metres.

(d) Formation of 57,000 sq. metres of storage ground.

The above works, commenced in June, 1926, were completed in July, 1933, except certain supplementary dredging operations, which were terminated in 1934.

5. Description of Works

The jetty or mole, improperly designated a breakwater, has been designed so as to follow as closely as possible a rocky ridge leading, naturally, in the direction imposed by the local marine

Port of Tangier—continued

conditions. This jetty constitutes a barrier against waves from the north-west, which strike it at an angle of about 15°. The protection afforded against these waves has surpassed the most optimistic forecasts; the waves do not round the pierhead, and the swell is dissipated to the East in the hollow of the bay, absolutely cut by a line north-west—south-west passing through the extremity of the work.

It goes without saying, that in the present stage of advancement of the works, so effective a result could not be expected in regard to the winds from the north-east. There is no protection whatever from the winds from east, south or south-west.

Shore End of Breakwater.

However, it is to be borne in mind that such winds are infrequent, and that in a southerly direction the swell has not the space requisite to intensify and become troublesome.

Protection against north-easterly winds will only be obtained by the accomplishment of a supplementary programme, either by the lengthening of the jetty by three to four hundred metres, terminating in a return arm towards the south-east, about 200 metres in length, or by a prolongation of the principal structure by six to eight hundred metres. The situation will be governed by the financial resources at disposal. It will depend also, in part, on the views more or less broad, taken in regard to the future of the Port of Tangier and its needs.

There is unanimous agreement for the present on the first part of the programme, which is concerned with the extension into deep water of the jetty and the quay. In fact, ideas on the development of traffic crystallise in the direction of passenger traffic, which could be increased to a remarkable extent by the diversion to Tangier of Far East lines, which now make Gibraltar their port of call.

6. Execution of Works: Quarries

The outlay on quarries and the communication road was a source of encumbrance to the undertaking. At the outset recourse was had to two quarries, which were quite close (2½ kilometres), and these would have sufficed if the original arrangements for the jetty had been adhered to. The extension of the scheme, so far as concerns this work, led to the prolongation of the existing road to a distance of five kilometres from the port, where was opened out a sound bed of sandstone, or grit, which has been able to furnish quantities even in excess of a thousand tons per day.

The sandstone is friable, the grains being coherent through pressure and not naturally cemented. The rubble blocks harden in the sea, but the use for concrete of broken stone from the stratum could only be a make-shift, and with the opening of the railway from Tangier to Fez, recourse was had to a quarry situated along the line at a distance of 22 kilometres from Tangier, and producing sandstone of satisfactory quality.

The mass of rubble stone of different categories extracted from the different quarries has amounted to a million tons. Divided between the categories, the output during the last year of exploitation has been:—

Unclassified: 10 tons—5 per cent.
Third category: 3 to 10 tons—37 per cent.
Second category: 1 to 3 tons—14 per cent.
First category: 1 cwt. to 1 ton—28 per cent.
Fragments below 1 cwt.—16 per cent.

The quarry output has reached 2.3 tons per lineal metre of face. The length of utilisable face is upwards of 270 metres, with heights of 20 to 45 metres.

7. Plant

The plant employed on the undertaking has comprised the following, amongst other items:—

Quarries:

2 gas motors of 80/87 h.p.
2 dynamos, continuous current, 440 volts.
1 motor of 32 h.p., serving a dynamo of 100 voltage.
1 air compressor, with reservoirs for compressed air.
2 steam cranes—3 tons capacity.
2 electric cranes—5 tons capacity.
2 steam cranes—7 tons capacity.
1 ditto —12 tons capacity.
1 ditto —15 tons capacity.
with various smaller appliances.

Sand Transport: Monorail and electric carrier of 1½ tons.

Track: One metre gauge.
5 locomotives—15 tons.
1 ditto —10 tons.
4 block carrier wagons—50 tons.
80 wagons for rubble transport—15 tons.
64 " Giraffe " wagons—3 and 4 cu. metres.
12 wagons called " Chouaris "—6 tons.
20 wagons with tip hoppers—2 cu. metres.
31 small " wheel-barrow " wagons—1½ cu. metres.
3 tank wagons.

Workyard:

2 gas motors of 80/87 h.p.
2 dynamos, continuous current, 440 volts.
1 fixed crane—3 tons.
1 Wilson concrete mixer—18/20 cu. metres per hour.
1 Gates stone crusher—20/40 tons per hour.
1 elevator.
1 pedestal crane—2½ tons capacity.
1 block carrier—45 tons.
1 titan crane, lifting 20 tons at 43 metres, and 50 tons at 28 metres—weight of the engine, 410 tons.
1 steam crane—3 tons capacity.
1 bascule bridge—25 tons.

Port of Tangier—continued

Temporary Pierhead at extremity of Breakwater.

It is interesting to note the special contrivance in regard to the titan crane. The machine is electrically operated, but the current, instead of being supplied from the central generating station, is produced on the machine itself by a steam engine and dynamos. This system, subject to some restrictions for refuelling and watering, renders the machine completely independent, and obviates all accessories in the way of leads for current, which are a source of grave inconvenience in time of storm.

The capacity of the titan crane has always sufficed to meet the quarry output.

In addition to the above enumerated plant, a floating sheers of 50 tons capacity was utilised in the construction of the quays of the Bassin à Barcasses (Barge or Lighter Basin), which were built of blocks of the type employed on the jetty, and which would have necessitated, in the absence of a floating machine, the use of a special crane with a whole system of tracks.

8. Jetty Profiles

Apart from several slight variations, the jetty has been designed to three leading cross-sectional profiles.

The Town and Harbour.

Port of Tangier—continued

1. Normal profile running from the root or shore connection to P.M. 866.
2. Submersible profile from P.M. 866 to P.M. 975.
3. Outermost profile consisting of a mound of rock rubble, without block covering, from P.M. 975 to P.M. 1021.

These sections are shown on the illustrated supplement.

9. Normal Profile

The theoretical cross-section comprises a core, or hearting, of stone fragments with upper surface levelled at one metre below zero, and having slopes of 2 to 1 on the seaward side and an angle of 45° on the inner side. This core is covered by stone rubble of the first and second categories, piled up to the underside of the platform and parapet wall. On the seaward slope, the mass is strengthened by large blocks of the third and unclassified categories. At the level, 1.70 metres above zero, there is a berm or ledge, nine metres in width, from which it descends to the level of one metre below zero at a slope of 3 to 1, increased to 1 to 1 from this level down to the natural foundation.

The outer slopes, as also the berm, are overlaid by a single row of concrete blocks. The two last blocks in the upper part, form a bed for the parapet wall. Above these is set a berm block in contact with the toe of the wall, specially placed to protect the foot of the jetty from the effects of the back-draught and recoil of the waves, which tend to create in front of the parapet wall a depression which would lead to the subsidence of the wall and would compromise the stability of the work.

10. Platform and Parapet

The jetty is crowned by a concrete platform of 1.80 metres (five feet) thickness, surmounted on the seaward side by a parapet wall 3.50 metres (11-ft. 6-in.) thick at the base. The platform is levelled at five metres above datum, and the parapet wall is provided with an offset at 7.30 metres and a coping at 8.60 metres above datum. Platform and parapet form, in the picturesque expression of the Chief Engineer, Monsieur Laroche, a "paper-weight," and contribute powerfully to the stability of the jetty, in the first place by their mass, and, secondly, in preventing the displacement of the rock work in the upper part.

As a matter of fact, the core of quarry refuse did not by any means reach the assigned upper level of one metre below zero, the proportion of fragments in relation to rubble at the quarry being very small.

11. Submersible Profile

Beyond the quayage zone, it has been necessary to evolve a section more economical than the preceding, by reducing the superstructure and limiting to two lines of blocks the revetment of the external slope, the inclination of which at 3 to 1 has, however, been continued down to four metres below datum. It is desirable to add that at the date at which the submersible profile was adopted, the quarry was in a position to furnish a large supply of blocks from 3 to 11 tons, which were employed on the outer flank of the work. Furthermore, the effects of the sea are notably diminished towards the extremity of the jetty.

12. Rubble Profile

Towards this extremity over the last 50 metres in length, the experiment has been made of a mound uncovered by artificial blocks and constituted by natural blocks of stone of 3 to 10 tons weight The two berm blocks, however, in front of the parapet wall, have been retained with a view to reducing the risk of fracture at this critical spot.

This profile has not, so far, suffered any detriment, and if a longer trial proves its sufficiency, a considerable economy over the preceding profiles will be effected in further extensions.

The profiles are applied to depths ranging from 10 to 12 metres.

It is of interest to note the constructional cost per lineal metre, which are as follows, for depths of —10 metres:—

Normal profile: 60,000 to 65,000 francs.
Submersible profile: 50,000 francs.
Rubble profile: 45,000 francs.

Landing Quay and Customs House.

Breakwater and Wave-breaker Blocks.

13. Concrete Blocks

The concrete throughout the work is composed of one part of cement, taken at 450 kilogrammes (9 cwts.) and two parts of broken stone. These must be considered limiting proportions.

(concluded on page 249)

Notes of the Month

New Fish Quay at Sunderland.

Sir George Gillett, Commissioner for Special Areas, has informed the Sunderland Corporation and the River Wear Commissioners that he is prepared to make a grant of £15,000 towards the proposed new fish quay at Sunderland. The scheme, which it is estimated will cost £45,000, will be carried out by the River Wear Commission.

Improvements to Port Talbot Dock.

The Great Western Railway Company announce that with a view to improving facilities for handling increasing traffic at Port Talbot Docks, it is proposed to reconstruct in reinforced concrete a length of approximately 230-ft. of Talbot Wharf, which has been disused for some time. When completed the wharf is to be equipped with three 3-ton hydraulic level-luffing cranes.

Wharf Extension at Singapore.

A section of the new West Wharf at Keppel Harbour, Singapore, where 10,000,000 dols. is being spent on an extension scheme has recently been brought into use. Three new godowns are available for shipping, a fourth is nearly completed, and a fifth is in course of erection. The use of the new section has enabled the demolition of the old P. & O. wharf at Keppel Harbour to be commenced. The entire undertaking, which it is expected will be completed by the end of 1938, extends over 3,000-ft. westward from the end of the present West Wharf.

Port of Mäntyluoto.

Mäntyluoto, the Port of Pori-Björneborg, Finland, which dates back to the year 1899 when the first quay and pier were built, has been gradually extended, numerous railway sidings having been laid down, spacious sheds erected and several large cranes acquired. When the present enlargement scheme is completed, Mäntyluoto port will have quayage totalling 1,200 metres in length. It is claimed that Mäntyluoto is the leading outlet in winter for Northern and Central Finland not only for geographical reasons but also because of the favourable ice conditions ruling there throughout the winter.

Increased Port Dues at Dublin.

At a meeting of the Dublin Port and Docks Board held recently, a resolution was passed increasing by 12½ per cent., as from September 1 next the dues on goods leviable in the Port of Dublin. In proposing the resolution, the Chairman said the Board found it necessary to raise additional revenue to meet the demand for increased wages and to provide for special expenditure on repairs in the immediate future. It was estimated that the increased dues would provide a surplus of £50,000. The Board hoped the measure would be of a temporary nature as they had reason to expect that when the oil refinery was in operation the additional revenue would more than justify the outlay incurred in providing the site.

Port of Genoa Improvements.

At the last meeting of the Port Facilities and Operation Committee of the Consorzio Autonomo del Porto di Genova it was decided to build a new warehouse with structural provision for electric cranes on the western quay of the Eritrea Mole, as well as to construct five electric cranes on the same quay. At the same time it was decided to construct the quay walls along the V Mole in the XXVIII Ottobre docks, to dredge alongside the Boccardo and Grazie quays, and to give the Società Anonima Ansaldo a concession for the construction of fitting out work in the XXVIII Ottobre basin, etc. In connection with shipping in the Port of Genoa it is stated that arrivals of machinery from the United States of America at Genoa to be transhipped to Switzerland are increasing, not only with Italian vessels, but also with American tonnage.

The Dartford-Purfleet Tunnel.

A modification in the design of the tunnel under the river Thames now in course of construction between Dartford and Purfleet has been the subject of recent legislation in Parliament. The original Act was passed in 1930 and this is now to be superseded by the Amending Act of 1937.

The major modification in the scheme is that the external diameter of the tunnel will be 30-ft. 6-in., instead of 34-ft., but the roadway width will be increased from 19-ft. to 20-ft., which has been provided for by restricting two narrow footpaths to patrol purposes only, as is provided for in the Mersey Tunnel. The alterations are due to representations made by the Port of London Authority concerning the requirements of dredging operations in the Thames, and also to the consideration given to the condition involved in carrying on the work at the original size and depth.

The new plans also provide for wider approach roads, both on the Kent and Essex sides of the river.

New Dock Head Signals at Hartlepool.

The L.N.E.R. is to introduce electric colour light signals at the Dock Head, Hartlepool, in place of the mast and ball type. The "colour light" signals of two aspects, green and amber, will function day and night, those for day use being of considerably greater candle power than those in use at night.

Additional Gulfport Facilities.

Important expansion of commercial and shipping facilities is announced by the Gulfport (Miss.) Port Commission. The commission intends to acquire the terminal facilities of the Illinois Central Railway (Gulf and Ship Island division), construct additional warehouse and shipping accommodation at a cost of $3,000,000 and secure a 30-ft. channel to deep Gulf waters.

Hudson River Navigable.

The United States War Department is about to spend $55,000 on dredging the Hudson River in order to remove seasonal shoaling in the deep water channel to Albany and to restore the depth to 27-ft. at mean low water. Commercial traffic in the Hudson River for the calendar year 1935, exclusive of ferry traffic, amounted to 10,288,411 tons, valued at $319,376,796. Deep water terminal facilities constructed by the Albany Terminal Commission at Albany have resulted in the creation of an ocean port with rapidly expanding traffic.

Increased Traffic through the Suez Canal.

An improvement in traffic was announced by the President of the Suez Canal Company, at the annual meeting of the shareholders held in Paris, on the 7th June, 1937.

The number of ships passing through the Canal has increased from 1,552 in the first quarter of 1936 to 1,679 in the first quarter of 1937, and the tonnage of cargoes has increased over the same period from 6,055,060 tons to 7,861,030 tons.

A substantial reduction of dues came into operation on April 1st, and that measure had been greeted with general approval.

The President referring to the Anglo-Egyptian treaty, said that in reply to a request from the Egyptian Government the company had decided to offer a large contribution towards the establishment of a road linking Port Said with Suez.

Record Cargo Transportation.

A transit period of eleven days from Bergen to Chicago and twelve days to the Twin Cities and Duluth has been achieved by the Norwegian-American Line on shipments of canned fish and cod liver oil. The steamer "Bergensfjord" which left Bergen on April 22nd arrived at New York on the morning of April 30th. The cargo for Western points was loaded into railroad cars the same day, the cars arriving at Chicago in the afternoon of May 2nd, and at Minneapolis and Duluth on May 3rd.

The expeditious movement stated to be a record in cargo transportation, is the result of special arrangements developed by the Norwegian-American Line, in conjunction with the Trunk Lines Association, to regain traffic via the Port of New York.

Impending Improvements at Galway Harbour.

At a special meeting of the newly constituted Harbour Board at Galway, held recently, it was decided to accept the tender of the Associated Contractors (Ireland) for carrying out the first stage of the developments at the harbour, authorised by the Irish Parliament in 1935.

The work comprises the deepening of the Approach Channel to give a minimum depth of 12-ft. at low water, the construction of a concrete blockwork pier for berthing tenders plying to and from the liners calling at Galway Bay, together with the widening and deepening of the existing entrance to the Dun Aengus Dock, including new gates and other incidental works. It is expected that the work, which will be started as soon as possible, will be completed towards the end of 1939. The deepening of the Approach Channel, which necessitates the breaking and removal of a large quantity of rock, will allow tenders to visit liners in the Bay at all states of the tide. At present this can only be done for about 3 hours before and after high water, necessitating the detention of the tenders in the Bay often for several hours before the arrival or after the departure of a vessel. The widening and deepening of the entrance to the Dun Aengus Dock will give Galway accommodation for vessels up to 356-ft. in length and up to 5,000 to 6,000 tons gross register.

The Consulting Engineers for the works are Sir John Purser Griffith, M.A.I., M.Inst.C.E., and Sir Cyril Kirkpatrick, M.Inst.C.E., with whom are associated Mr. W. N. Binns, B.E., Harbour Engineer, and Mr. M. J. Kennedy, B.A., B.E., M.Inst.C.E.I.

Thames Barrage Proposal

Debate in the House of Lords

In the House of Lords, on May 27, **The Earl of Dudley** drew attention to the need for a Governmental public inquiry into the condition of the River Thames in London and into the proposal to build a barrage at Woolwich. He moved for papers. The following account of the discussion is extracted from "The Times."

He said that nothing whatever had been done during the several decades that had elapsed since the scheme for a barrage at Woolwich was first mooted, and it had not been given the real examination by a high authority that it deserved. During recent years the scheme had been sponsored by a body known as the Thames Barrage Association, with the support of many representative organisations. But so powerful were the vested interests of the Port of London Authority, who opposed the scheme, that no headway had been made to establish a public inquiry, which was all that was asked, to examine the proposals, which by general consent offered many great advantages.

Their lordships when taking tea on the terrace of the House might see when the Thames was at low tide several miles of ugly, insanitary mud flats on both sides of the river. By a comparatively simple and inexpensive scheme that could be done away with to the benefit of public health and convenience and in the interests of commerce. The scheme had been sufficiently well drafted to stand the closest examination.

By damming the Thames at Woolwich they could make 30 miles of river above Woolwich a slowly moving lake with a constant high level from bank to bank. It would be 1,500-ft. wide and would provide docks for shipping and a valuable new roadway across the river which would connect the north and south circular roads, and at the same time effect a juncture between the northern and southern railway systems. The total cost would be about £4,500,000.

Sanitary and Other Advantages

Among the major advantages would be that of maintaining two-way traffic along the river at all times. The next main advantage was one of public health. At present 335,000,000 gallons of only partly treated sewage was injected into the river every day, 61 per cent. of which came from the works at Barking Creek. This outflow was below the proposed barrage at Woolwich. Most of this was brought up the river on the tide and not carried away to sea on the ebb-tide. He believed the ill-effects of this disgusting pollution were recognised by the Minister of Health, and he understood that there was a scheme for taking all the sewage out of the river into the Channel at a cost of something like £62,000,000. If the barrage were erected none of this sewage could enter the tideless lake.

The next consideration was one of public safety and complete security against flooding. There would also be constant access to the wharves and steps along the river front, including entry to the docks, which at present could only be reached at high tide. The aesthetic considerations he could safely leave to their lordships' imagination. There were many other advantages bringing economy in their trail, such as dredging, the handling of goods, etc. He did not know a single disadvantage with the exception perhaps of some temporary inconvenience to a few ships whose top hamper would only allow them to go under bridges at low tide.

Lord Jessel said that a scheme of the sort proposed for London had been successfully achieved at Boston, in the United States, and in place of the mud banks from the tides with which they were cursed in London the citizens of Boston had a full river which provided them with many amenities, including all kinds of yachting clubs. That had been achieved with no difficulty at all. In the Port of Amsterdam similar works had been carried out successfully, the Rhine had been extensively canalized, and in England we had the outstanding example of the Manchester Ship Canal. It seemed somewhat unfortunate, in view of these examples, that they could not get the Port of London to hold a public inquiry into the matter.

When a question was asked in the House of Commons the Minister of Transport said that the project had not an influential enough backing to warrant the cost of a public inquiry. But he thought the names of those associated with the Thames Barrage Association or otherwise supporting the scheme were influential enough to justify an inquiry. It had been said that the Port of London Authority was a law unto itself and that the Government had no authority over it. The Authority was composed of 28 members, of whom 18 were elected by the payers of dues and by those who owned docks on the river. The London County Council and the City Corporation also had representation on the Board, but they were in a very small minority.

The private interests were in a tremendous majority, and it was suggested that these private concerns were fearful that this barrage scheme might militate against their commercial interests. If that was the case he did not think it was a good ground for not having an inquiry. If it should prove true that the scheme was going to hurt these private interests then nobody would grudge the payment to them of adequate compensation for any loss that might be incurred. Even if a barrage scheme did cause loss to private interests they must all agree that those private interests must give way to the greater good of the health and amenities of London. He hoped that the Port of London Authority would assent to the request from the Thames Barrage Association for a public inquiry. If the Port of London Authority would not do so, then he believed that a growing public opinion would compel the Government to step in and hold the desired inquiry.

Opposition of Port of London Authority

Lord Ritchie, who was heard with difficulty in the Press Gallery, was understood to say that there was absolutely no foundation for the suggestion that the private interests of members of the Port of London Authority had led to their opposing this scheme. As Lord Dudley had said, this was not a new proposal. Certain similar proposals were made as long ago as 1799 and there had been several since. Every one of these proposals had been killed or died of neglect, and he hoped that one of these fates awaited the present proposal. Members of the Port of London Authority, of which he was chairman, had been cognizant of this particular scheme for the last two years.

Under the Port of London Act certain duties in relation to the condition of the water were laid upon the Authority. These were observed as far as possible, and the Authority had laid down certain standards of purity for all the effluents discharged into the river. Those standards were rigorously enforced. But the Authority had no control over the London County Council, who discharged into the river every day 280,000,000 gallons of sewage effluent which was not by any means up to the Authority's standard of purity.

This had been a source of great concern to the Authority for many years past, and both the County Council and the Government were aware of this concern. He did not say this by way of criticism of the County Council. He had great sympathy with them in the problems they had to deal with and he was satisfied that they must be giving the matter very careful consideration.

The promoters of the scheme said that the barrage would improve the condition of the water in the river. In the opinion of the Authority the reverse would be the result. The best expert advice they could get was that above the proposed barrage the constant high level of water would prevent the free discharge of tributary streams containing sewage, and that below the barrage there would be gross pollution of the river at a greater intensity than now existed.

Effect on Navigation.

The P.L.A. had greater experience of the "locking" of ships and small craft than any other body in the world. On last year's figures, 43,000 ships and 462,000 craft of one kind or another would have to be locked. Those numbers were increasing year by year. It would be a physical impossibility. Ships did not run to time; they were not scheduled like trains. They came when they pleased, and sometimes—especially in fog—in rushes. They needed space to manoeuvre. He understood the proposal provided for six locks. Bearing in mind the necessity for manoeuvring, it would not be possible to use more than half of them at the same time. That was a matter of paramount importance, outweighing any benefit that they were told would come from the barrage, and was fatal to the scheme.

During the War they had a good deal of experience of the bombing of London. The enemy used the river as their guide, and frequently the docks as their target. None of the bombs happened to hit any of the quays, locks, or warehouses. The only damage received was from our own anti-aircraft guns. If the proposed dam was successfully bombed at or about low water it would be an appalling disaster.

There was no river in the world like the Thames. It had certain natural advantages which rendered it peculiarly adaptable for the handling of ships and the transit of goods. It was because of these advantages that London had sprung into existence and had become the greatest concentration of mercantile and industrial activity in the world, the banking and insurance centre, and the greatest market in the world. They were asked to sacrifice these advantages in order to provide themselves with a lake of doubtful purity in the upper reaches of the tidal waters. During the past 28 years the net registered tonnage of shipping using the port had increased from 38,500,000 to 61,796,000. He claimed that that enormous increase of traffic had been provided for by the foresight of the Authority. It was strange that an association knowing nothing of the trade of the port should now seek to teach them their own business.

The Authority had always listened to proposals from trading organisations or individuals with sympathy and sometimes had

Thames Barrage Proposal—continued

been able to adopt valuable proposals. The Thames Barrage Association had not the support of any shipping, trading, wharfing or lightering organisation, or of any local authority.

Lord Desborough said that he believed that if the barrage scheme was carried out it would be one of the finest things ever done for London. At least there might be an inquiry.

London County Council's Attitude

Lord Snell, speaking from the standpoint of the London County Council, said that the problem was primarily one that affected the Port of London Authority, alongside which the L.C.C. had to live with as much good feeling as possible. Everybody would admit that the state of the water in the river was far from satisfactory; but it was only fair to say that the L.C.C. had spent a great deal of money on trying to improve those conditions. Schemes were already being operated and there was reason to hope that in the near future there would be some definite improvement. The County Council had arrived at no decision in this matter, but he would say at once that if this barrage were to damage the Port of London in any way then the whole of London immediately became seriously interested.

View of the Thames at Woolwich Ferry.

They had heard the statement by Lord Ritchie that the Port of London would be injured. In the face of such a statement the County Council would not feel able to take sides in the matter until it was better informed. There were engineering problems relating to the disposal of storm water which they would like to be better informed about before they expressed any opinion on them.

Then there would be the possible effect of the barrage on the levels of the river at high tide, which they would like to know something more about. There was also the problem of main drainage, and connected with that was the question of the health of the people of London. The L.C.C. would rejoice to have a clean, fresh-flowing river, but they wanted to know what the probable results were going to be before they committed themselves to any opinion on this proposal.

Government Reply: Objections to Inquiry

The Earl of Erne, Lord in Waiting, said that the main reason why the Minister of Transport was not in favour of an inquiry was that Parliament in 1908 gave to the Port of London Authority the full responsibility of looking after the interests of the Port of London and the River Thames; and that Authority, for the reasons stated by Lord Ritchie, was opposed to the scheme. The Minister of Transport had consulted with the Minister of Health on this subject, and he, too, was opposed to the scheme, first, because he considered that the barrage would hold up such sewage and trade effluents as were discharged above the barrage.

The Minister of Health opposed the scheme, secondly, because it would cause an accumulation at the flood tides immediately below the barrage of heavy polluted water, which would be deprived of the purifying effect of movement with the tide; and it was probable that a condition which was reasonably satisfactory while the Thames was an open river would cease to be so under the new conditions unless a heavy expenditure were incurred in more intensive treatment of the effluents. The third objection of the Minister of Health was that the holding up of the land water would increase the risk of flooding above Richmond.

The Minister of Transport had also been in consultation with the President of the Board of Trade, and the latter was also unfavourably inclined towards the scheme. He considered that the river trade would be impeded rather than facilitated; and in his view it did not seem practicable in the space available to provide locks of sufficient capacity to cope with the volume of traffic. The process of locking would also involve delays and congestion of shipping with an increased danger of collisions, particularly in thick or foggy weather. In addition there would be an immense dislocation and loss of trade and industry during the construction of the barrage, which would take some considerable time to build.

Although some riparian and local authorities and other bodies had passed resolutions in favour of an inquiry, there had been no substantial demand by any responsible shipping, trade, or commercial organisation, or by local authorities interested in the river and port. In these circumstances the Minister of Transport still saw no reason which would justify him in putting the numerous interests concerned to the expense and trouble of an inquiry. He hoped that in view of what had been said Lord Dudley would not press the motion.

Concluding Protest

The Earl of Dudley said that the debate had turned out exactly as he had expected it would do. It was quite obvious that the Government had been briefed by the Port of London Authority and that in these matters the Government were entirely in the pocket of the Port of London Authority. (Laughter). Lord Ritchie had not put forward a single arguable reason against an inquiry. Everything he said and everything that Lord Erne had said supported the argument for an inquiry. This was not a one-man scheme. He was interested in it because he was President of the Parliamentary Science Committee, which had on its board most of the practical scientists in England. They were all in favour of this project. There was an answer to every point made by Lord Ritchie.

Because the Port of London Authority refused to carry out this inquiry the comfort, convenience, and prosperity of thousands of London citizens had got to suffer. He did not feel that this was a matter which he should press to a division, although he believed that if he did there would be a majority of the House in favour of it. He hoped that this debate had shown Lord Ritchie that there was an enormous body of opinion in favour of this project and that he could not hold out much longer against the demand for an inquiry. Efforts would be continued until this inquiry, which they thought to be in the public interest, was obtained.

The noble lord withdrew his motion for papers.

The Port of London Authority*

By Sir DAVID J. OWEN, M.Inst.T.

General View of Shipping in the Royal Albert Dock.

THE subject of my lecture is "The Port of London Authority," which is a Body that has been in existence for a period just over 28 years.

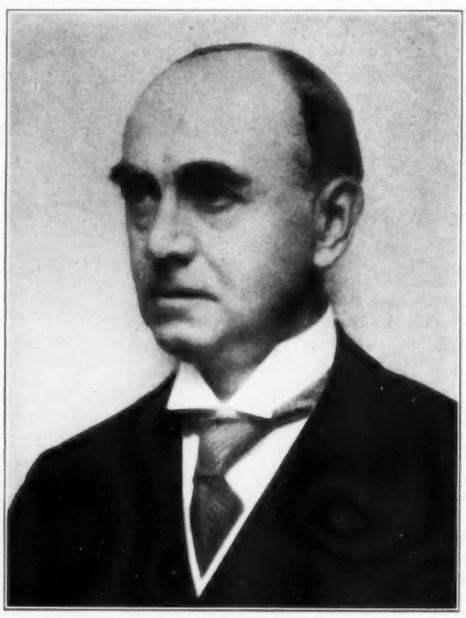
The Port of London itself has had a much longer life. For its birth we must go back some 2,000 years. From the time of the early Britons, through the Roman occupation, through the period of the Danes and the Saxons, through the Middle Ages and up to modern times, the Port of London has persisted with practically no interruption as a place for ships to discharge and load goods from and to places over the seas. Its progress during those twenty centuries reflects the history of this country.

It is not within the scope of this lecture to unfold the record of the rise and early development of the port. It is a long and fascinating story, but to deal with the Port of London Authority, I must start with the last year of the nineteenth century.

At that time there were within the Port of London three Dock Undertakings, each owning groups of docks and each concern, although established by Act of Parliament, being of the nature of a private company with the object common to commercial concerns of earning dividends for their shareholders.

The River Thames, itself largely the cause of London's greatness, was controlled by a statutory Authority—the Thames Conservancy.

At this time the Dock Companies were generally not in a very good financial position, and one of them deposited a Bill in Parliament seeking powers to make certain charges. It need not concern us at the moment what powers were sought, but the fact was that considerable opposition was aroused with the result that the Bill was rejected.



Sir DAVID J. OWEN, M Inst.T.,
General Manager, Port of London Authority.

The Government, however, announced that the Port of London was of such importance, from a national point of view, that it ought to receive full enquiry.

Report of Royal Commission

In the year 1900 a Royal Commission was appointed to investigate the affairs of the Port, and in two years the Commission issued its Report, which contained recommendations for the creation of a new Authority or Public Trust to take over and administer the property, powers and obligations of all the Dock Companies, of the Thames Conservancy below Teddington, and of the Watermen's Company, the last-named being an ancient Institution and having certain powers and duties connected with watermen.

The concluding paragraph of the Report of the Commission contained very impressive words which are worthy of quotation, as they explain concisely the condition of the Port at the time and the reason for the establishment of the Port of London Authority.

It reads: "We desire to say that our enquiry into the conditions of the Port of London has convinced us of its splendid natural advantages. Amongst these are the geographical position of the Port; the magnitude, wealth and energy of the population behind it; the fine approach from the sea; the river tides strong enough to transport traffic easily to all parts, yet not so violent as to make navigation difficult; land along the shores of a character suitable for dock construction and all commercial purposes. In addition to these advantages, London possesses docks which, although they are not in some cases upon the level of modern requirements, are yet capacious and capable of further development. The deficiencies of London as a Port, to which our attention has been called, are not due to any physical circumstances, but to causes which may easily be removed by a better organisation of administrative and financial powers. The great increase in the size and draught of ocean-going ships has made extensive works necessary both in the river and in the docks, but the dispersion of powers among several authorities and companies has prevented any systematic execution of adequate improvements. Hence the Port has for a time failed to keep pace with the developments of modern population and commerce, and has shown signs of losing that position relatively to other ports, British and foreign, which it has held for so long. The shortcomings of the past cannot be remedied without considerable outlay. We are, however, convinced that if in this great national concern, energy and courage be shown, there is no reason to fear that the welfare of the Port of London will be permanently impaired."

Needless to say, the Report aroused much controversy among the various sections of the business community and those interested in the Dock Companies. The argument was used, no doubt in good faith by some, especially those who were wedded to the older doctrines of political economy, that the destinies of the Port would be better in the hands of competitive private enterprise than under any form of public control. It was, how-

*A lecture delivered to the London School of Economics on June 9th, 1937.

Port of London Authority—continued

ever, abundantly clear that private enterprise had failed, so far as London's docks were concerned.

The controversy continued, and it was not until six years after the Royal Commission's Report had been published that a Bill was passed by Parliament. There was still opposition, and it is interesting in this day, over 28 years later, to hear of the gloomy views that were taken of the future of the Port of London.

One prominent man, representing an important interest, wrote to "The Times" as under:—

> "Should, however, this measure become law, the future "policy with regard to the Port of London will have been "irrevocably fixed, and fixed, we mal-contents believe, in "such a manner as to bring about its early decadence and "final decay."

During the debate on the Bill, it was stated in Parliament that "The Bill was full of uncertainties and speculative. The only "result which was absolutely certain to follow the passing of "the Bill was to make the Port of London poorer than it had "been hitherto, and to render it more difficult for their mer-"chants and manufacturers to compete with their foreign "rivals."

West India Docks, 1836.

It was also said that the effect of passing the Bill would inevitably be "to reduce labour and increase unemployment," that "It was another nail in the coffin of private enterprise—"another step in the direction of socialism."

Port of London Act, 1908

The Bill, however, became law under the title of the "Port of London Act, 1908." It transferred the undertakings and powers of the Dock Companies to a new Body—the present "Port of London Authority"—a Public Trust to be run for the public good, somewhat on the lines of the governing Bodies of the Ports of Liverpool, Glasgow, Leith, Newcastle, Belfast and others. The idea was no new one, as the similar Bodies at the other Ports I have mentioned had been in existence for many years; for example, the Mersey Docks and Harbour Board at Liverpool is now about 90 years old. It is perhaps important to remember this, as I have seen references to what is frequently called the new idea of business management by Public Trusts, such as the Port of London Authority, the Electricity Commissioners, the London Passenger Transport Board. In the realm of Ports it is no new idea.

The Port of London Authority, in accordance with the Act, consists of 28 members, 10 of whom are appointed and 18 elected as follows:—

1	appointed by	the Admiralty.
2	,, ,,	Ministry of Transport.
4	,, ,,	London County Council.
2	,, ,,	Corporation of the City of London.
1	,, ,,	Trinity House.
18	elected by payers of Port dues and charges, wharf-owners and the owners of river craft.	

The Authority have the power to elect a Chairman from outside their number if they so desire, in which event the total membership is 29.

The primary duty thrown upon the Authority was, to quote the words of the Act, "To take into consideration the state of "the River and the accommodation and facilities afforded in "the Port of London, and, subject to the provisions of this Act, "to take such steps as they may consider necessary for the "improvement thereof."

The task which confronted the new Authority was unquestionably an arduous and responsible one. In the first place, the organisations of the old Dock Companies and of the greater portion of the Thames Conservancy, had to be welded into one, and then the steps to be taken to improve the Port had to be carefully planned.

The River Thames

The River Thames received first consideration. It will be obvious to anybody that in the nature of the approach from the sea to any port will be found the factor which governs the size of the vessels that can use the Port. Where Ports are situated some distance up a river the difficulties increase, as there is always a tendency for certain parts of the waterway to silt up, and dredging has to be resorted to for the purpose of maintaining the requisite depth of water. Ships have also, from motives of economy in transport, been increasing in size, thus drawing more water.

In 1909, when the Port Authority took charge, the ruling depth in the channel from the estuary to Gravesend at low water of ordinary spring tides was 25-ft., and this depth gradually decreased all the way up to the City. It will be borne in mind that the range of tide on the River, that is to say, the difference between low water and high water, varies up to 21-ft.

The deepest draughted vessel that had used the Port up to that time drew 27-ft. of water, but vessels were getting bigger.

Parliament was so impressed with the necessity for improving the River that they imposed a definite obligation upon the Port Authority to form and maintain an adequate river channel to meet the demands of shipping. This obligation has been fully discharged, and now there is a good navigable channel 1,000-ft. wide, with a general depth of 30-ft. at mean low water of spring tides from the Nore to Cold Harbour Point up the river, a distance of about 35 miles. From that point to the Royal Albert Dock, a stretch of six miles, the channel is 27-ft. deep and 600-ft. wide. Then for over four miles, as far as the entrance to the West India Dock, the depth is 20-ft., with a width of 600-ft. Above that place the channel continues sufficiently deep and wide to enable fairly large steamers to ascend that part of the River known as the Pool of London, between London Bridge and Tower Bridge.

The dredging necessary to accomplish this result involved the removal from the bed of the river of 50,000,000 tons of material at a cost of over £2,000,000.

While the River was undergoing this drastic treatment the various dock systems were also receiving attention.

The Dock Systems

Apart from the River, the Port's most important feature is its five wonderful dock systems. They have a total water area of 722 acres, and the quays for the discharging and unloading of ships have a total length of about 45 miles. Each has some special trade or trades for which it specially caters, and is also equipped for the handling of general cargoes.

The London and St. Katharine group of docks, situated in the shadow of the Tower of London, were built over a hundred years ago, and then sufficed for the largest vessels that were in existence. Now those docks are used by relatively small vessels up to 1,000 tons gross register engaged in the coastwise and Continental trades.

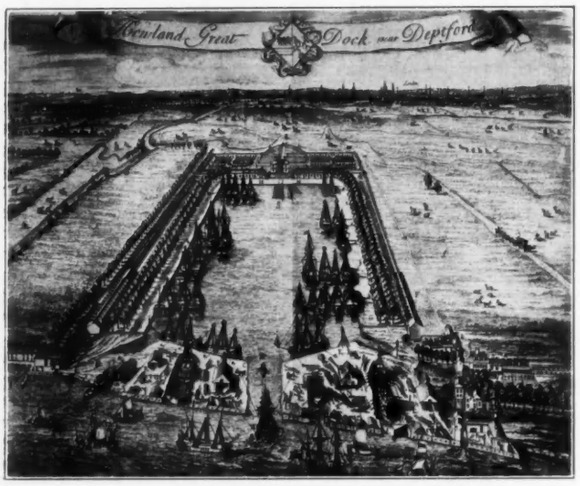
The East and West India and the Millwall Dock system lies on the north side of a bend in the River in the district known as the Isle of Dogs. Built partly by the old East and West India Merchants over 130 years ago, they still, after, of course, considerable improvement, serve a most useful purpose for fairly large foreign-going vessels.

Further down the River, about 10 miles from London Bridge, are the Royal Victoria, Royal Albert and the King George V. Docks, all connected with each other and forming perhaps the largest sheet of enclosed dock water in the world. The Royal Victoria and the Royal Albert were the two docks here which

Port of London Authority—continued

were handed over to the new Port Authority in 1909. The King George V. Dock was constructed by the Authority and opened in 1921. In these docks are to be found steamships of many famous lines which ply to all parts of the world.

Still further down the River, some 25 miles from the City, are situated the Tilbury Docks, which originated a little over half a century ago. These docks have been immensely improved and extended by the Port Authority. The new entrance constructed in 1929 is one of the biggest in the world, being 1,000-ft. long by 110-ft. wide. Some of the largest vessels which use the Port are accommodated in these docks.



Howland Dock (Surrey Commercial Docks) in 1700.

All the docks mentioned are on the North bank of the River, and there is only one group on the South side. These docks are called the Surrey Commercial Docks. They embrace the site of the old Howland Great Wet Dock, which was constructed so far back as the year 1696. It was the first wet dock to be built in this country, or perhaps in the world. After a period it was used extensively by vessels engaged in the Greenland fishery trade, and became known as the Greenland Dock. Enlarged, improved and with other docks added to it, the group subsequently was absorbed by the Surrey Commercial Dock Company, and eventually handed over to the new Port of London Authority. Now one of the docks, still known as the Greenland Dock, is the home of many cargo liners from Canada and the United States, while the other docks in the group are mainly used for the discharge and storage of timber, of which over 2,500,000 tons are landed in London annually.

To recite all the improvements and works executed by the Port of London Authority at these various dock systems which I have mentioned would only be interesting to the technical mind, and I shall content myself by saying that they embrace, apart from the new King George V. Dock and the dredging of the River which I have already alluded to, extensions of old docks, new quays, sheds and warehouses, and an extensive array of modern cargo-handling appliances.

It is difficult to convey an idea of the difference between the docks and warehouses as they exist to-day and as they were twenty-five years ago. The total lineal quayage of the docks and basins was 41¾ miles in 1909; now it is 45¼ miles, but this includes six miles of reconstructed quays which have been converted from non-effective into really effective use. The capacity of the docks to accommodate shipping has been increased by 60 per cent. The total area of the Authority's estate is now 4,197 acres, compared with 2,700 acres twenty-five years ago. The extent of the improvement in equipment will be apprehended if we compare the 970 cranes of the first year of the period under review with the 1,500 now in operation in the docks.

The magnitude of the work accomplished may be gathered from the expenditure on capital account, which in 28 years has amounted in round figures to the sum of £17,000,000.

I may here mention that the sum paid to the old Dock Companies for their Undertakings when the Port Authority was created was £23,000,000, so that it will be seen that the capital account of the Authority now stands at the figure of £40,000,000. This money has been obtained by borrowing from the Public by the issue of Stock at rates of interest varying from 3 to 5 per cent. per annum.

So to administer the finances that after the payment of working expenses there is left a sufficient margin to cover the moderate interest and sinking fund charges on the capital, is the aim of the Authority.

Functions of the Authority

Just a word to explain the functions of the Authority. Briefly stated, they consist in providing and maintaining the necessary River channel to enable vessels to enter and leave the Port and in affording the requisite accommodation in the shape of docks and quays where ships can safely lie in order to load and discharge their cargoes. Ancillary to all this, is the supply of appliances for the handling of those cargoes, the provision of sheds in which goods may lie while in transit, and of warehouses in which goods may be stored for a period if desired, and of road and rail access to those quays and warehouses.

The Authority's functions are not confined to the provision of premises and equipment. Through their staff they actually handle a great deal of the merchandise that passes through the Port. When goods are landed on the dock quays the Authority take charge of them, placing some direct on to road vehicles or railway trucks for immediate conveyance to their destinations and depositing others in warehouses until required for home delivery or re-export.

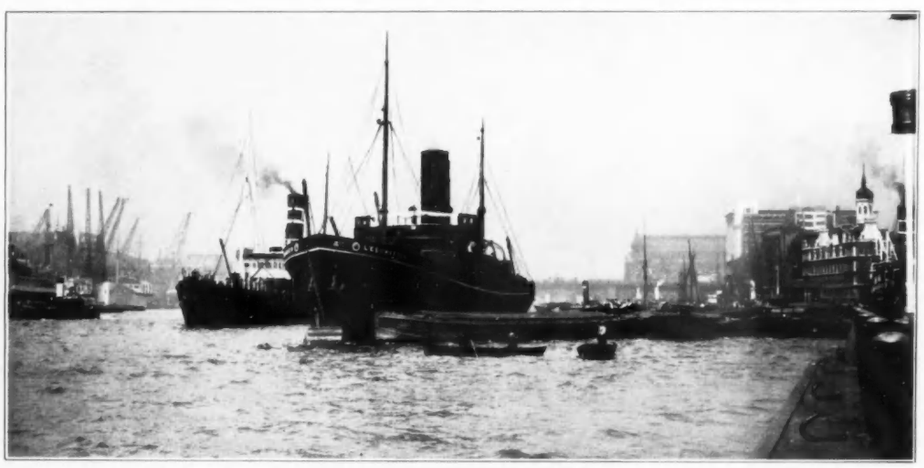
The revenue of the Authority is derived from dues and charges levied on vessels and goods for the use of the river, docks, quays and warehouses, and for the special services rendered by their staff in the handling of the goods, and so on.

Under the regime of the Port Authority the business of the Port of London has expanded enormously. At no other period during its long history has its trade approached to anything like its present dimensions. The bare statement that annually 62,000,000 net registered tons of shipping now arrive at and depart from London (it was only 38,500,000 in 1909) and that £467,000,000 worth of merchandise passes through it from and to the Dominions, Colonies and foreign countries, gives us an indication of the magnitude of its commerce at the present day. And when we consider that the volume of shipping mentioned is over a sixth of the total shipping using all the Ports of the Kingdom, and the value stated is over one-third of that of all those Ports, we cannot but feel that it is a remarkable phenomenon.

Indeed, London presents to the student of history and political economy a fascinating problem. While we can understand that the physical advantages of the site of London were favourable to the establishment of a Port and community, the cause of its selection as the capital of the country and its subsequent prodigious development are not so clear.

That it has grown so big no doubt causes difficulties from some points of view, but it must not be forgotten that economic forces exert their sway, and it is difficult to interfere with them.

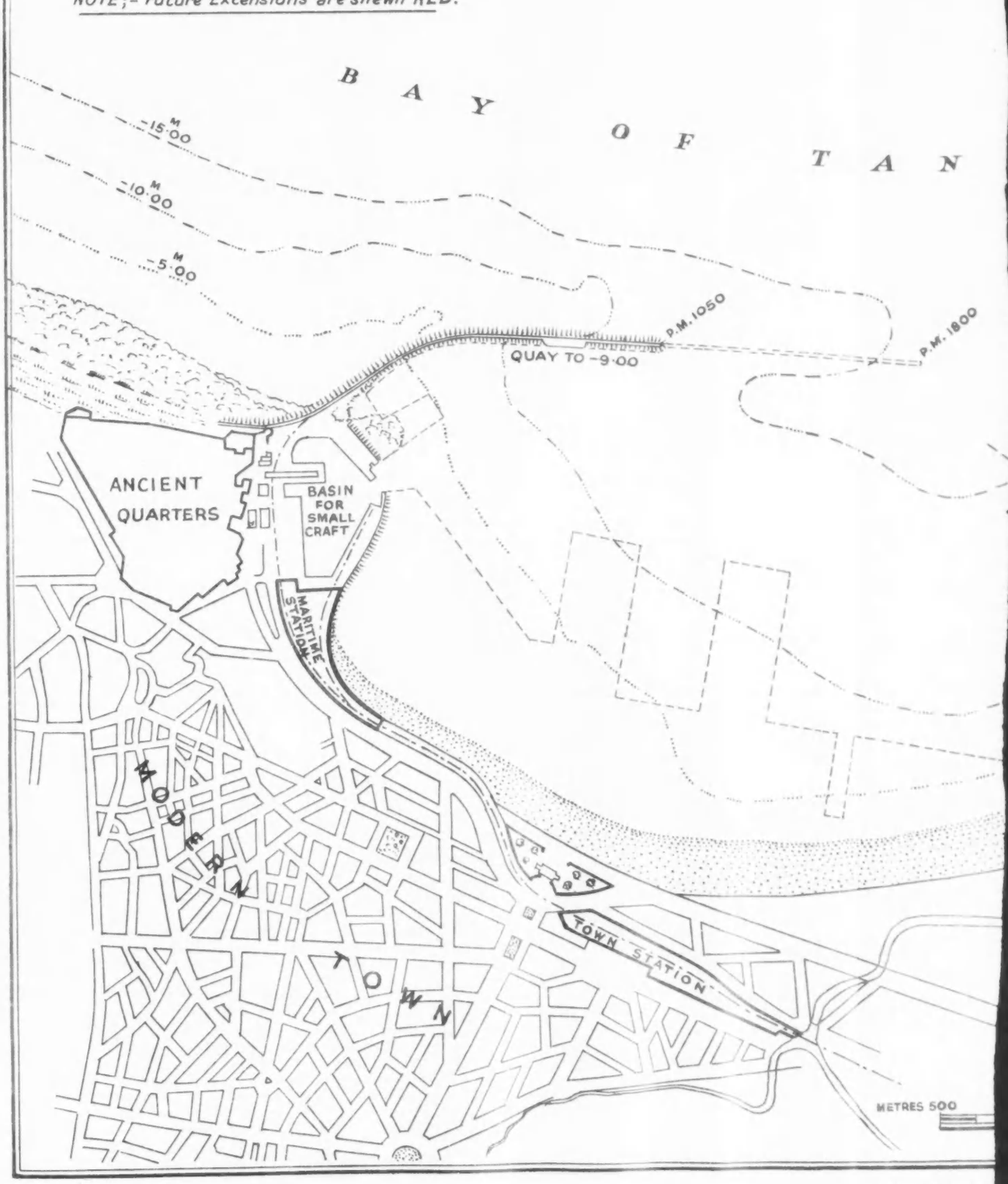
The Port of London Authority was created to satisfy an economic demand. That it is fulfilling that demand seems un-



The Pool of London from Tower Pier.

PORT OF TANGIER.

MONSIEUR ANTOINE FAYARD, INGENIEUR DES TRAVAUX PUBLICS D'ETAT DE LA ZONE DE TANGIER.



WARD & FOXLOW, LITH.

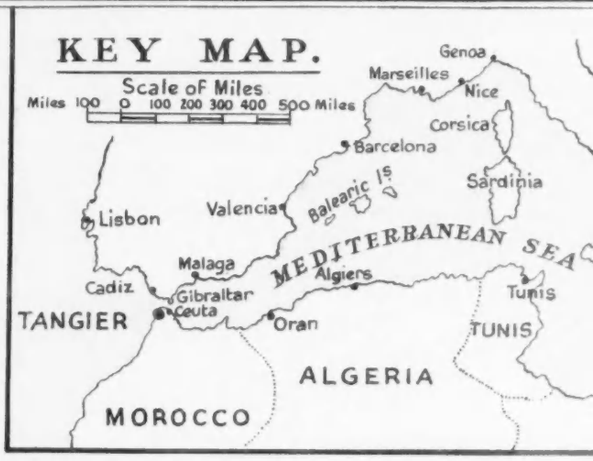
R.

DE TANGIER.

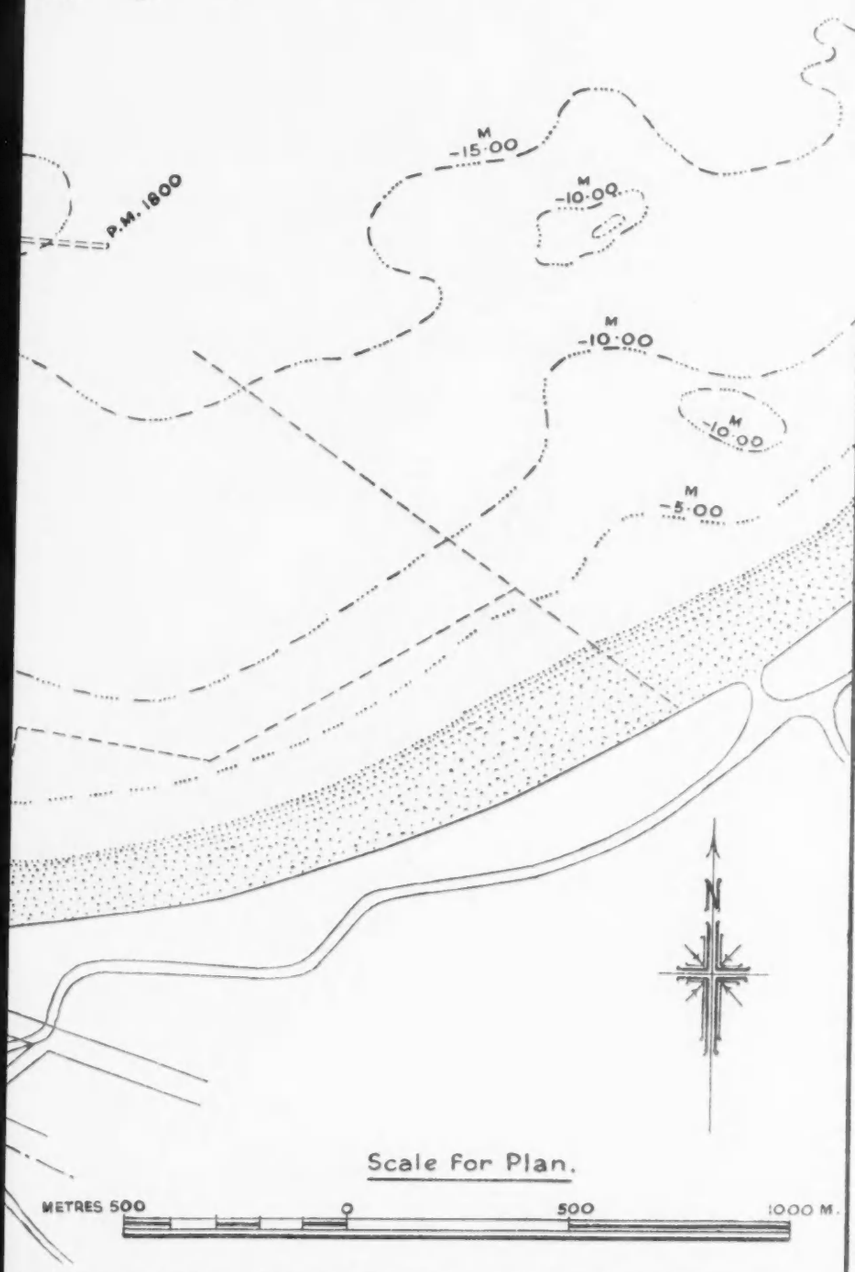
KEY MAP.

Scale of Miles

Miles 100 0 100 200 300 400 500 Miles



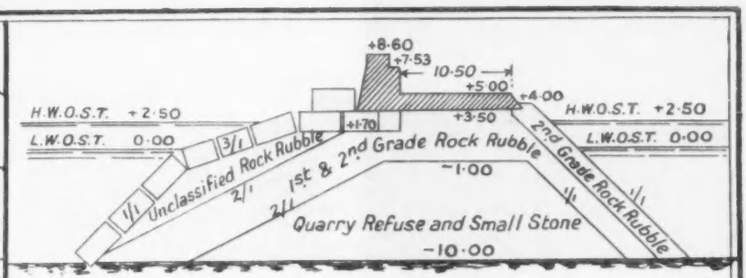
A N G I E R



Scale for Plan.

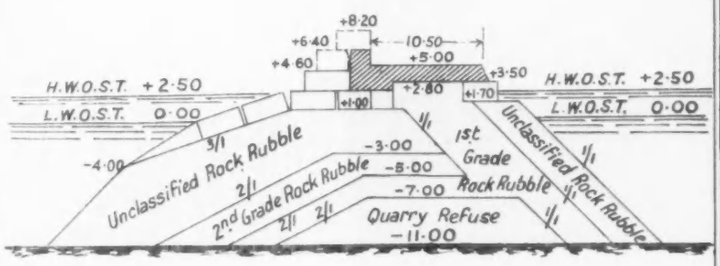
METRES 500 0 500 1000 M.

WARD & FOXLOW, LITH. HARCOURT STREET, MARYLEBONE, W.

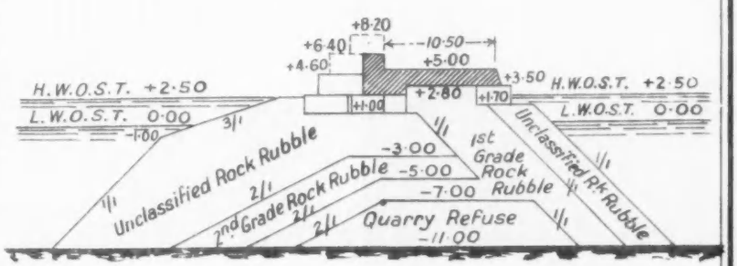


BREAKWATER.

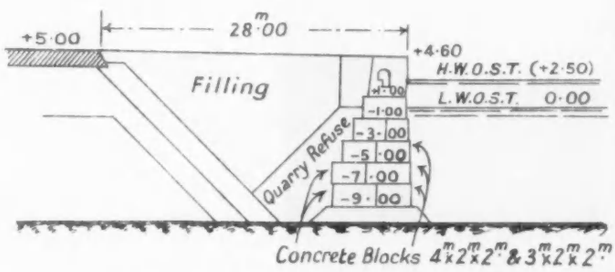
NORMAL SECTION FROM COMMENCEMENT TO P.M.915.



SEAWARD SECTION FROM P.M.915 TO P.M.960.



SEAWARD SECTION FROM P.M.960 TO EXTREMITY.



SECTION OF QUAY.

Port of London Authority—continued

questionable, having regard to the fact that since it was formed the shipping trade of the Port has increased by 61 per cent. and the importation and exportation of goods by about the same figure.

This forms a striking comment on the predictions made in 1908, and shows how dangerous it is to prophesy. I will not attempt to do so, but, like the old Hebrew prophet, I dream a dream and see a vision, and it has a still greater and more efficient Port of London in the foreground with a background indicating, if not a fading-off of competitive private enterprise, at least a greater extent of co-operation and planning in those departments of our national life, which we term public utilities.

However that may be, the demand for accommodation in the Port of London still continues, and the Port Authority would be failing in their duty if they did not take steps to satisfy that demand. They must anticipate the needs of the future especially as new docks, quays, sheds and other facilities cannot be constructed in a day.

Programme of Development

Accordingly, the Authority have surveyed the position, and have prepared a programme of modernisation and development for the future. The works included in that programme are estimated to cost the huge figure of £12,000,000.

I use the term modernisation with significance. It will be realised that many of the docks with their warehouses, etc., were built from 100 to 130 years ago, and although maintained in an adequate manner, yet the time must inevitably arise when some premises will require reconstruction to be in accord with modern conditions of transport and to be capable of more economical maintenance and working.

A commencement has already been made on certain of the more urgent works included in the first stage of the programme to which I have referred. Among the more important of the works appearing in this first section, the following of the larger improvements may be mentioned to illustrate the widespread character of the whole, but it must be appreciated that the figures quoted as costs are not in any way detailed estimates but merely rough calculations based on prices operative a year ago when the scheme was prepared:—

The north side of the Royal Victoria Dock, until recently, consisted of a series of jetties extending into the dock in a southerly direction, each with a shed. Work is already in progress to cut away these jetties, and in their place to form one continuous quay, 3,250-ft. in length, furnished with five up-to-date warehouses of three storeys each, at a total cost of nearly £1,200,000.

On the other side of the dock is a site known as The Mudfield which, after being derelict for some time, is now to be developed with a concrete quay, sheds and equipment at a cost of over £400,000.

At the Surrey Commercial Docks work is soon to commence on the rebuilding of No. 1 Warehouse, South Dock, which was completely gutted by a spectacular fire in the early part of last year, and at some later date a new four-storey warehouse is to be built on an adjacent site, costing in all £200,000.

A large proportion of the Authority's quays are equipped with hydraulic cranes. In view of the comparatively high cost of power to work hydraulic cranes as against electric cranes, and the difficulties experienced with the former during cold weather, it has been decided to electrify certain of the quays at various docks. To do so, and to provide the necessary cranes and other mechanical appliances, will cost another £250,000.

The building of new sheds, the reconstruction of bridges and quays and certain other improvements, together with the works already specified, complete the first stage of the modernisation and development scheme on which will be expended somewhere between 2¼ to 3 million pounds.

The remainder of the programme, which will cost from 9 to 9⅝ million pounds, provides for a large number of works which will be carried out according to financial and other circumstances from time to time.

Book Notices

North Eastern Ports.

The London and North Eastern Railway Company are extensive proprietors of docks on the North East Coast and they have recently issued the eleventh edition of an informative volume, called "Ports of the London and North-Eastern Railway, 1937." It is a useful and attractive compilation giving descriptions and full particulars of the various dock systems and harbours under the Company's control, ranging from the Tay southward down to Harwich. The descriptions of the ports are accompanied by maps and photographic illustrations enabling a very clear idea to be obtained of the extent of the accommodation and facilities available for shipping. Other serviceable features are a set of tide tables and a list of steamship services. The volume is in every way an admirable reference work and will be welcomed by shippers, agents and others who wish to acquaint themselves with the conditions prevailing and the services available on the Western Coast of the North Sea.

"The Said Noble River."

In commemoration of the Coronation of their Majesties King George VI. and Queen Elizabeth, The Port of London Authority have published a book entitled "The Said Noble River," a phrase applied to the Thames in the Common Council Acts. The Author, Mr. Alan Bell, describes graphically the pageantry of past and present days on the wider reaches of the Thames and also gives a brief outline of some of the achievements of the Port of London Authority during the last quarter of a Century. The numerous illustrations, finely produced from old prints and modern photgraphs, form an attractive feature of the book, which is obtainable from the Head Office of the Port of London Authority, price 2/6d.

The Port of Boston (Port Series No. 2).

We have received a copy of the 1936 Report on the Port of Boston, Massachusetts, U.S.A., compiled by the Board of Engineers for Rivers and Harbours, War Department, and the United States Maritime Commission. The report is a revision of the data published in previous issues, and gives information with regard to port and harbour conditions; port customs and regulations; services and charges, fuel and supplies; and the facilities available for service to commerce and shipping, including piers, wharves, grain elevators, storage warehouses, bulk freight storage, dry docks and marine railways, marine repair plants, floating equipment, and wrecking and salvage facilities. Railroad and steamship lines are reviewed and information presented regarding their charges and practices in connection with terminal service. Numerous tables show in detail the foreign and domestic waterborne commerce at the port during the period 1926-35, and information is also given concerning the origin of imports and the destination of exports, as well as the origin and destination of intercoastal traffic during the calendar year 1935.

Southampton Docks.

The 1937 Edition of the Southampton Docks Handbook published by the Southern Railway, has been revised and appears in a completely new form. The book, which is well illustrated and has a new cover design, describes how the Outer Dock with an area of 16 acres, has grown to a Dock Estate of 640 acres, and how the 400-ft. graving dock built over 90 years ago, has been eclipsed by the largest graving dock in the world, the King George V Graving Dock. The present edition consists of over 130 pages and contains many items of general interest. There is for example, a whole page in colour depicting the funnels of a number of the Shipping Companies who use the Port. Another feature is a page of facts and figures at the back of the book, showing the considerable volume of goods and passenger traffic handled at Southampton.

New Vessel for British Guiana.

Messrs. Ferguson Brothers (Port Glasgow) Ltd., launched on the 14th June, the Twin-Screw Diesel Engined Cargo and Passenger vessel, "Lady Northcote," which has been constructed to the order of the Crown Agents for the Colonies for the Transport and Harbours Department of the British Guiana Railways. The vessel was launched almost complete, with all machinery aboard, and was christened by Mrs. Macdougall, wife of A. Macdougall, Esq., General Manager Transport and Harbours Department, Georgetown.

Annual Report of the Duisburg-Ruhrort Harbour Company.

According to the annual report of the Duisburg-Ruhrorter Hafen A-G., this company, of which the share capital of 18 million marks is held by the State of Prussia and the Municipality of Duisburg, closed the year 1936 with a net loss of 555,691 marks, compared with a net profit of 3,900 marks in the previous year. This net loss, which is covered by reserves, is due, it is stated, to the extra expenditure on harbour maintenance and improvement and dredging of the waterways, including 480,000 marks on the lowering of the harbours, rendered necessary by the sinking of the river bed.

Total receipts for the year rose by 15.5 per cent. against those for 1935 as the result of an increase in traffic of 17.6 per cent. Expenditure on the other hand amounted to 7.9 million marks, as compared with 5.6 million marks in the previous year, an increase of 2.3 million marks or 41 per cent.

Harbour Works at Baltic Ports

Report on the following subject to the XVIth International Navigation Congress at Brussels

Dimensions to be given to Harbour Works, particularly to Locks, Quays, Graving Docks, Fixed and Movable Bridges (clear width and navigable span), Section, Depth and Lay-out of the Approach Channels, in order to suit the possible Future Dimensions of Large Packet Boats

By M. NAGORSKI, Engineering Director of the Administration of the Port of Dantzig

I—Generalities

THE question of dimensions to be provided for the various works in seaports cannot be looked upon in the light of a single general problem that can be applied with indifference to all such ports considered as a whole, but rather as a problem applying to each port in particular, or at any rate as a regional problem capable of a solution that is common to a certain number of ports in which the circumstances are analogous.

It goes without saying that it is quite inconceivable that all such ports, even the most important of them, should be so equipped that they could handle the largest vessels in the world, seeing that the plying of such ships is restricted *a priori* to a very small number of ocean routes and, in each country concerned, to a very small number of ports.

The S.S. "Pilsudski" moored alongside quay at Port of Gdynia.

On the other hand, each port must set itself and solve the question as to what maximum dimensions of vessels it must provide accommodation for, viz., if not throughout the whole of the port, at any rate alongside certain isolated structures, what will be the dimensions of the largest vessels likely to berth there at the present time or in the near future? Set in this manner, the question appears different in the case of each particular port.

In practice, however, it is often very analogous for a whole group of important ports whose geographical situation is similar, as is the case, for instance, for the large Baltic or Mediterranean ports. An individual problem thus changes into a regional problem.

Thence, two entirely different questions in this domain have to be taken into consideration:

(1) The question of the absolute maximum dimensions, viz., the dimensions to be coped with in ports that expect to handle the largest vessels in the world's fleets.

(2) The question of the relative maximum dimensions to be coped with in other large ports.

The question of absolute maximum dimensions only concerns a very limited number of seaports: those whose geographical situation and other economic circumstances justify the expectation of having probably to deal with the largest vessels in the world. These maximum dimensions only practically come into consideration for ports forming either a terminus or a port of call for the most important transatlantic companies running regular services between the U.S.A. and western European countries, such as the ports of Liverpool, Southampton, Le Havre, Bremerhaven and Cuxhaven.

This general question ought to be studied carefully by the representatives of these countries which carry on transatlantic traffic by means of very large vessels. It would be of little use to discuss this question here in an incomplete manner, and that is why we considered it would be preferable to leave its discussion to reporters who are better able to undertake the task and restrict ourselves in this paper to discussing the relative maximum dimensions in other ports or groups of important ports, and in particular the regional problem of Baltic ports, having in view more particularly the two ports situated on Polish Customs territory: Dantzig and Gdynia.

The two main items appear as decisive in estimating maximum dimensions to be provided for harbour works in a large seaport or group of ports in which the local circumstances are similar.

In the first instance, the geographical situation must be examined from the point of view of navigation conditions, seeing that in many instances the natural dispositions themselves, and particularly the depths of the immediate approaches to the ports or in the channels communicating with the open sea, may *a priori* render the navigation of vessels of a certain size impossible. The question is, in particular, of decisive importance for ports situated on enclosed or semi-closed seas, and which can thus only be reached by passing through channels that are favourable or straits having a restricted depth of water.

In addition to these pre-existing natural dispositions one must take account in the second place of economic circumstances, seeing that it is they who define the nature and dimensions of vessels calling at the ports considered or which are likely to call there in all probability. Even the greatest technical facilities will not succeed in attracting to the ports in question a given traffic if the desired economic conditions do not exist.

When examining the requisite economic conditions for traffic to be carried out by large vessels one must also take into account financial considerations, with a view to seeing whether the extent of the sacrifices entailed by the creation of the requisite technical dispositions for handling large vessels is compensated to a certain extent by the economic advantages to be expected from such traffic, and then as to whether such harbour works will be used sufficiently often. It is not every port, for instance, that will be disposed to lay out considerable sums of money for bringing about the conditions required by very large vessels if the latter are only going to call there in exceptional and very rare cases.

In such research we must also take account of what will be the nature of vessels upon which will depend the dimensions to be given to harbour works. Three classes of vessels have to be considered for this purpose: warships, large passenger liners and cargo carriers, as well as vessels carrying both passengers and cargo.

The problem of warships forms part of a particular question concerning mainly naval ports and which do not come within the scope of our Navigation Congresses. We must hence take each particular case into consideration: the question of maximum dimensions required for large packet-boats on the one hand, and for large cargo carriers on the other hand.

We find that large passenger liners only have a decisive influence on the maximum dimensions of harbour works in ports that belong to the former category, viz., those which have to handle the largest packet-boats in the world. The draught of the latter considerably exceeds that of large cargo carriers. On the contrary, in the case of other important ports, which we have classified in the second category, it often happens that the draught of cargo boats calling at these ports is greater than that of passenger boats. In such a case the maximum dimensions of the harbours will have to be suited rather to the requirements of cargo boats than to those of passenger liners. That is what usually happens in the case of important ports in the Baltic.

* Reprinted from the Bulletin of the Permanent International Association of Navigation Congresses, No. 22, July, 1936.

Harbour Works at Baltic Ports—continued

II—Dimensions of Harbour Works in the larger Baltic Ports and in particular in Ports situated on Polish Customs Territory

In conformity with the principles explained above, we will first look into the natural geographical conditions in the Baltic prior to traffic by large vessels and then into the general economic data concerning traffic of such ships.

As the Baltic must be considered as an enclosed sea, the dimensions of vessels that are able to ply in it are subject above all to those of the principal approaches to it. The latter are, on the one hand, the Kaiser Wilhelm Canal, and on the other the Straits between Denmark and Sweden.

Vessels not exceeding the following dimensions can pass through the Kiel Canal: draught 9.50 m.; maximum beam 40 m.; length 315 m.; height of masts above the water-line 40 m. Each lock has a chamber with a working length of 330 m. and an available width of 45 m. For most of the shipping lines the Kiel Canal is the shortest and most convenient route to the Baltic. It is only in the case of Norwegian and Scottish ports, and for lines running to North America by the northern sea route, that the easiest access to the Baltic is via the Danish straits.

On the other hand, vessels steaming from the west and south-west towards the Baltic are not always obliged to use the Kaiser Wilhelm Canal. They can also steam round Denmark and pass through the straits, which means, it is true, a loss of 12 to 24 hours, but the latter is offset by a large saving in canal-dues. There are two main routes to the Baltic through the Danish straits: via the Sund (Drogden), passing close to Copenhagen, suitable to vessels having a maximum draught of 8 m. That is the route that is used in the great majority of cases.

The other route, which passes through the Storebelt, has much greater depths, and vessels drawing a maximum of 11 m. can use it. The same figure applies to a branch of this route, viz., the Lillebelt.

These desiderata mean that access to the Baltic is possible for vessels having a very deep draught, but nevertheless, via routes that are comparatively little used. In reality, one must take account mainly of navigable conditions in the Kaiser Wilhelm Canal and partly in the Sund, with the result that vessels that have a draught of 9.50 m. must be considered normally as the largest type visiting the Baltic regularly, all the more as certain passages situated on the Baltic shipping routes have at certain spots, in the immediate proximity of the navigable channel, depths that in times of bad visibility may hamper vessels drawing over 10 m. (e.g., near the Adlergrund).

But a Baltic port that wishes to be prepared for all eventualities must also make provisions for vessels coming through the Storebelt or the Lillebelt, viz., the possibility of handling vessels drawing more than 10 m. of water.

If we now look into the economic data in connection with the traffic of large steamers in the Baltic, we must remember that since the war many Baltic ports have developed a lot and that consequently the sea-going traffic of these ports has also changed a good deal. Before the war most transatlantic shipping lines, both to North America and to other parts of the world, had their terminal ports in the west of Europe, such as Hamburg and Antwerp. Baltic ports were then served from such termini of the large lines by auxiliary steamship services of lesser importance.

After the war we saw in all the Baltic ports a tendency to create direct long-distance communications, whilst the considerable increase of the Swedish and Norwegian fleets, and to a lesser extent the Danish fleet, helped a lot to further the realisation of these projects. On another hand, new Baltic independent States had been created, such as Finland, Estonia, Latvia, Lithuania and Poland, states for which the requirements of overseas traffic necessitated direct long-distance communications.

The creation of these connections was facilitated by the fact that, owing to a great excess of available tonnage, freights dropped a lot, whilst on another hand most shipping owners attach much less importance than formerly to as high a speed as possible between the terminal ports of the various shipping lines. Thus, many lines which formerly only went to a western European port have shown themselves disposed to prolong their regular voyages as far as Baltic ports, with a view to thus creating the desired direct connections.

As the first Baltic port, Copenhagen has developed a lot and has taken from western European ports part of the traffic running to the Baltic. The large Swedish ports have also made themselves independent in many respects; thus, the cotton traffic which formerly flowed through Bremen has been attracted straight to Gothenburg and Stockholm. Many Norwegian shipping companies have displayed great activity in the Baltic, and have extended to Baltic ports the communications that existed between Norway and countries oversea.

The Finnish merchant fleet, on its hand, has created direct communications with South and North America, as well as with other countries outside Europe. From the first post-war years onwards, ports situated on Polish Customs territory, viz., first Dantzig and later Dantzig and Gdynia, created direct communications with North America for the outgoing and homewards flow of emigrants. During the later development a need made itself felt to also create, with a view to avoiding the use of foreign ports, direct sea-communications for goods traffic. At the start, the solution of this question mainly consisted in attracting to Dantzig and Gdynia foreign shipping companies, but later on we saw the creation of Polish shipping lines which carry on traffic over the most important routes. At the present time there are at Dantzig 15 lines running to countries outside Europe and at Gdynia as many as 81. The supplying of such an important economic field as Poland, with her 33 million inhabitants, requires a direct supply from overseas countries of raw materials, such as cotton from North America, rice from India, exotic seeds for the manufacture of oils and so forth. In return, products manufactured in Poland, timber and cereals are exported to those oversea countries.

Seeing the low prices of most raw materials in the world's markets, one must necessarily choose the cheapest route for transport, just as, with a view to creating a reserve of foreign currencies for the national exchequer, transit via foreign railways must be avoided as much as possible. Owing to relatively cheap ocean freight rates, the direct transport of merchandise towards our home ports is much cheaper than transit via the large western European ports which, although somewhat quicker, entail higher charges for re-forwarding by rail. Direct traffic to our home ports is also much more advantageous for the development of regular commercial relations between Baltic states and overseas countries, because transit via foreign ports entailed, in most instances, commercial transactions in the latter.

All these causes helped to create in the Baltic, after the war, a very lively commercial and maritime revival, and in particular a considerable development of long-distance direct communications between its ports and faraway ports outside Europe. That development was necessarily bound to bring about an increase of the average tonnage of vessels calling at Baltic ports. We might cite, as an instance, that at the Port of Dantzig the average tonnage was 324 net register tonnage in 1913 and increased to 650 net register tonnage in 1930. At Gdynia the average tonnage at the present time is 950 net register tonnage.

This development is due, above all, to goods traffic between Baltic ports and oversea countries. But passenger traffic has also become much more intense, both of emigrants, before the introduction in the U.S.A. and most other countries concerned of restrictive measures which we know so well, and of ordinary passengers.

The Danish and Swedish shipping companies operate a series of first-class lines for passengers between their ports and North and South America. As regards departures from Poland, there are a few foreign shipping companies, such as the American Scantic Line, for traffic with North America, as also a Polish line, the Gdynia-America Line, on which the older vessels were replaced during September, 1935, by quite new liners of 14,400 gross register tonnage. These ships, the "Pilsudski" and the "Batory" were built at Monfalcone near Trieste; they have a total length of 156.5 metres (513 ft. 4½ in.), an extreme beam of 22.5 m. (72 ft. 6 in.) and a maximum draught of 7.8 m. (25 ft. 6 ins.). It was originally intended to have these vessels built with a deeper draught, but in view of the depths existing in the Sund—through which the normal route used by this line passes—we had finally to restrict the draught to 7.8 m.

In addition to the normal traffic, the Baltic ports have seen the tourist trade increase to a certain extent, large vessels from America, Great Britain, etc., undertaking pleasure cruises in the Baltic. Among such vessels there are sometimes very large ones, although they do not reach the size of the larger vessels plying on the regular steamship services between western Europe and America.

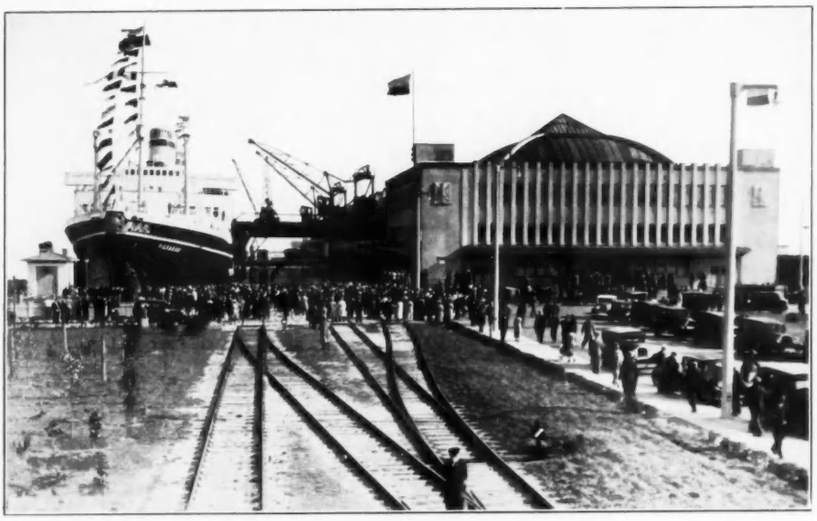
In spite of the considerable development of passenger traffic, it is nevertheless clear that the economic conditions required for very large liners of 30,000 tons and over do not exist in the Baltic. The operating of such ships already shows losses on routes from the large western European ports, and there would be no sense in using such ships in the Baltic. The number of passengers is much too small for that, and the traffic mainly consists of persons who have to look to their pockets above all and would not be in a position to pay for a berth on really luxurious liners. Owing to this fact, it is probable that for carrying passengers between Sweden, Denmark, Poland and other Baltic ports and North America, a vessel of the size of the "Pilsudski" (Polish: 14,400 gross register tonnage) or the "Gripsholm" (Swedish: 17,716 gross register tonnage) may be considered for some time ahead as amply sufficient.

If we now compare the dimensions of these vessels to those of the largest cargo boats calling at Baltic ports, we notice

Harbour Works at Baltic Ports—continued

that, as regards draught in particular, cargo carriers reach much higher figures than what are reached by passenger boats calling at these ports. Thus, in 1934 there called at the Port of Gdynia cargo boats that sailed from thence with a draught of 29 ft. 5 ins. (" Romsdalshorn ": Norwegian, carrying a cargo of 10,812 tons; " Riv ": Italian, with a cargo of 9,750 tons). Dantzig was used by vessels which the owners could not load to their full extent, such as the " Altai Maru " (Japan) with 31 ft. 1 in., and the " Providenza " (Italian) with 29 ft. 11 ins. draught. These draughts were considerably in excess of those of the largest passenger ships using these ports.

After having thus succinctly sketched the technical and economic circumstances upon which navigation in Baltic ports depends, we will now explain in what manner the problem of dimensions was solved in most of these ports, and at Dantzig and Gdynia in particular.



Port of Gdynia, Poland.

The majority of the large Baltic ports only counts upon traffic which we have defined as normal in their home waters, viz., vessels having a draught of less than 9 m. A list of questions sent round to most of the large Baltic port authorities revealed that, except in the case of Dantzig and Gdynia the largest vessels that had called at their ports had a draught of 8 m. to 8.50 m. The approach and principal parts of these ports usually have a depth of 9 to 11 m. of water. On the contrary, except in the case of Gdynia, the depths of water alongside the quay-walls do not exceed 9 m. The harbour authorities of the ports in question declared that these depths are considered as sufficient.

The following table supplies data concerning the chief ports in the Baltic:—

Port	Maximum depth beneath mean tide	
	Water in the harbour	Alongside quays
Copenhagen ...	10 m.	9·1 m.
Malmö		9·25 m.
Stockholm ...	10 m.	7·9 to 9·9 m. (up to 4 m. from the quays)
Helsinki	9 m.	8·2 m.
Tallinn	9·15 m.	8·8 m. (1 m. from the quays)
Stettin	9 m.	9 m.
Lübeck	8 to 10 m.	
Dantzig	9·5 m.	9 m
Gdynia	10 to 12 m.	10 m.

If we bear in mind that all the Baltic ports are open ports, without any locks, the other dimensions of vessels, such as their beam and height above the water-line, clearly play no part when determining the dimensions of the harbour works. In most of the ports there are, above the principal waterways, no bridges likely to eventually restrict the dimensions of vessels. The bridges that span the Kaiser Wilhelm Canal are so built as to allow the passage of ships having a height of 40 m. above the water-line. Over the Lillebelt there was recently built a bridge (fixed) giving a clearance of 33 m. beneath it. If, on the other hand, we bear in mind the large dimensions of the locks on the Kiel Canal, we shall see that, among the dimensions of ships entering the Baltic, it is only the draught that can cause any restrictions.

We will now go more closely into the question of the depths and dimensions of harbour works in ports situated on Polish Customs territory, viz., Dantzig and Gdynia.

The Port of Dantzig

The Port of Dantzig is situated on the old mouth of the River Vistula and the whole of its harbour works extend along the banks, arranged for the purpose, of the original river, which has been supplemented by various canals and distribution basins. At about 20 km. upstream from Dantzig the waters of the Vistula are led direct, through an artificial cut, to the Baltic Sea, and thus there are no currents, floods or ice jams to be feared in the port itself.

The roadstead provides anchorages of 10 to 20 m. depth, with a good anchorage soil composed of sand and clay. It is protected by the Hela Peninsula and is only open towards the north-east.

The entrance to the port consists of two longitudinal breakwaters, of which the longer protects it against wind from the north-east. The distance between the pierheads of these moles is 80 m., and the approach channel dredged in front of these pierheads has in its first stretch a width of 250 m. and a depth of 10.5 m. The second stretch in the neighbourhood of the pierheads has a width of 150 m. and a depth of 10 m.

In the port itself, and more especially in its maritime part properly speaking, the depth of the navigable channel is 9½ m., except for certain sections which are far away from the entrance to the port and which are only of lesser importance to shipping (Mottlau and Tote Weichsel, upstream from the mouth of the Mottlau). In several places in the port, and in particular at the mouth of the Mottlau, at the tip of the Holminsel and on the bend upstream from the canal basin, they have also provided turning spaces for vessels. One of these turning places has a diameter of 300 m. and a depth of 10 m., the others having a diameter of 200 m.

The depths in the navigable channel may therefore be considered as favourable, which is proved moreover by the fact that even ships of the size of the " Columbus " and " Homeric," which were built at Dantzig in the Schichau shipbuilding yards, were able on leaving the port to sail through practically the whole of the harbour, but not completely loaded. The most difficult spot for navigation consists in the sharp bend situated at the upstream extremity of the canal basin, a bend which was already widened by dredging during the war. In spite of the presence at this spot of a turning space 200 m. in diameter, vessels of exceptionally large dimensions have to negotiate this bend very carefully, especially when there is a strong wind. It should not be forgotten, however, that all ships do not have to sail round this bend because the free port, the Westerplatte basin and the canal basin are situated downstream.

As to the depths of water available for berthing alongside the quay walls, they vary a lot, according to whether the quays are of recent or old construction. The old quays in the free port and at the Vistula station only give a depth of 4½ m., but the incline of the river bed nevertheless enables vessels drawing 7 m. to berth. The first stretches of deep water quays, in the Kaiserhaven, were built before the war and have a depth of about 8 m. of water at their foot. After the war, the extraordinary development of maritime traffic in the port caused the authorities to undertake re-arrangement work on a large scale. Not only did they modernise old sections of quays, viz., provide them with new sheds, cranes and railway lines, but they also built new quay walls and new basins. In 1926 they first constructed, upstream from the Vistula station, a stretch of quay 400 m. long, with 8 m. of water for berthing. In 1927 they built a basin for the trans-shipment of goods in bulk, having about 900 m. of quays and a depth of water of 8 to 9 m. In 1924 already the port authorities had built, for the special purpose of trans-shipping war material, a small basin having a depth of 9 m. of water and some 650 m. of quays; the depth of water at the foot of the latter is 8 to 9 m.

Nearly all the quay walls at Dantzig are founded on wooden piles supporting a floor of reinforced concrete. The piles are encased in concrete to about 50 cm. below mean water level. The thrust of the earth is partly offset by a screen of wooden sheet piling anchored to the rear and which is not placed in front of, but behind, the reinforced concrete floor. This type of construction, which is very economic, has in general withstood well, except in a few rare cases where the soil is partly composed of very fine sand and where the sheet piling screen

Harbour Works at Baltic Ports—continued

was not sufficiently watertight to entirely keep back the sand. In the new structures they adopt a greater width for the reinforced concrete floor in order to still further lessen the height of the screen of sheet piling.

This general survey shows that, in the new parts of the port, the depths of water alongside the quay walls are also sufficient for coping with normal requirements and enable them to handle vessels drawing about 9 m. During the post-war years traffic in the Port of Dantzig has developed to an extraordinary extent; thus, the tonnage of shipping, which in 1912, the best pre-war year, amounted for incoming traffic to 970,653 net registered tons, amounted in 1930, the most favourable post-war year, to 4,143,098 net registered tons. The total movement of merchandise, which in the last few years before the war amounted on an average to 2,270,000 tons, reached 8,330,000 tons in 1931, thus exceeding that of all the other Baltic ports. In 1934 the tonnage of incoming vessels amounted to 3,174,892 net registered tons, and the total merchandise handled to 6,369,000 tons.

The Port of Gdynia

The Port of Gdynia was created entirely after the war in the western part of the Bay of Dantzig at a place where a wide strip of flat land joins the mainland to the coast. It is situated about 20 km. to the west of Dantzig and is also protected by the Hela Peninsula. The port was planned and built right from the start to handle really large vessels. It differs from most Baltic ports by the width of its approaches, the area of its fore-port, the considerable width of its basins and its great depths of water, both in the navigable channel and alongside its quays.

The Port of Gdynia comprises two parts. The outer port was constructed in the sea by building four wide moles separated from the open sea by a breakwater of great height. We have thus created, in front of the old coastline, three large maritime basins and an outer harbour. The inner harbour, on the other hand, consists of basins dredged in the flat land and which open out on to a canal basin capable of being lengthened in case of need and alongside of which we intend to eventually build an industrial port.

Depths in the roadstead run from 9 to 14 m. That of the approach channel to the port has been increased by dredging to 12 m. The port at present has three entrances. The main entrance has a width of 140 m. and leads to the outer harbour, to the first outer basin and to the basins of the inner harbour. Two small entrances, 70 m. in width, give access to two other basins in the outer harbour, situated further to the south. In the future, the port will only have two approaches; the present main entrance, and a second entrance in the southern part of the outer harbour, and for which a width of 150 m. is planned. The depth of the navigable channel is 12 m. in the outer harbour and 8 to 10 m. beyond. It will be increased to 11 m. from one end to the other.

The canal basin which connects the outer harbour to the inner basins and to the first basin of the inner harbour has a depth of 10 m. In the outer basins, which are kept for trans-shipment of goods in bulk, the depth of water is 8½ to 9 m.; as to the depth of the second inner basin, although it is now maintained at 8 m., it will subsequently be increased to 9 m.

As regards the depth of water available at the foot of the quays, the Port of Gdynia possesses in the outer harbour, near the new harbour station for passengers, a stretch of deep-water quays with 12 m. of water.

In the outer harbour, along the quays used for trans-shipment of merchandise in bulk, the depth varies from 8 to 9 m., and there is partly 10 m. and partly 8 m. at the foot of the quay walls of the first inner basin.

We ought to mention, in addition, that the outer harbour and the various basins are very spacious, with the result that ships can manœuvre even without the aid of tugs very easily; thus, the width of the first inner basin is 250 m., that of the second inner basin 200 m. and so on. The outlet from the outer harbour into the inner harbour also has a width of 250 m.

The Port of Gdynia thus, both from the point of view of depth and that of width of its various parts, gives extraordinary facilities for the handling of very large vessels which can berth at all times alongside quays where they will find depths up to 12 m.

All the stretches of quays at Gdynia consist of reinforced concrete caissons built in series in a workyard placed ashore. After having been floated by excavation of the soil beneath them, and taken to their places in the works, these caissons were sunk on the site of the quay wall to be built by ballasting them with sand, gravel, etc. The quays thus form continuous walls with vertical sides. This method of construction, which was also used for building the breakwaters, has proved to be very cheap and practical.

The traffic of the Port of Gdynia has developed very rapidly. Inwards, the tonnage of ships amounted in 1934 to 4,142,142 net registered tons and the total of merchandise to 7,191,913 tons. In 1932 the traffic of the Port of Gdynia was practically equal to that of the Port of Dantzig, whilst since that year Gdynia has even topped the figures for Dantzig; as far as the total trans-shipment of goods is concerned, Gdynia now occupies first place among Baltic ports, the second place being taken by Dantzig.

Conclusions

If we summarise the various considerations set forth above, we may say that:—

(1) The question of maximum dimensions for harbour works must be studied and solved separately for each port, or at any rate for each group of ports, taking into account both the geographical situation and navigable conditions in the approach channels to the ports in question, as well as economic data which may militate in favour of handilng large vessels.

(2) As regards Baltic ports, the dimensions of vessels calling there are *a priori* restricted by those of the approach channels and in particular by the depths in the Kiel Canal. Vessels normally plying in the Baltic have a draught of not more than 9.50 m., although vessels drawing more can also enter it through the Danish Straits.

(3) Economic conditions in the Baltic led to a considerable development of shipping after the war, especially long distance direct communications, but which are mainly carried on by cargo boats or ships carrying passengers and cargo. Thus, in the Baltic it is not passenger vessels but cargo carriers which determine the depths of harbour works.

(4) Most of the large Baltic ports are equipped for handling vessels drawing 8 to 9 m. of water.

(5) The two ports on Polish Customs territory, Dantzig and Gdynia, have taken first places among Baltic ports as regards the quantity of goods handled. In both of them, but particularly at Gdynia, the depths provided for shipping may be considered as very satisfactory, in regard to circumstances existing in the Baltic. Dantzig is capable of handling vessels drawing 9 m. of water and Gdynia those drawing even 11.3 m. Other dimensions, such as the width of the approaches to the port, navigable channels and various basins, are, especially in the Port of Gdynia, also very satisfactory.

The Port of Tangier

(concluded from page 242)

The section of the blocks, which was originally two metres by two metres, has been reduced, on grounds of economy, to 1.80 metres by two metres, the lengths being three and four metres, corresponding to weights of 23 to 32 tons.

14. Quay Wall

The quay wall is formed of blocks, two metres by two metres by three metres and two metres by two metres by four metres, bonded so as to break joint. It would have been preferable to use special blocks, each corresponding to the full width of section in the particular setting. This was not possible, for it would have exceeded considerably the lifting power of the titan crane at the distance of setting (38 metres from the axis of the machine).

The wall is founded at the level of nine metres below datum on a mound of stone, the height of which ranges from 0.8 metres to two metres; two rows of sacks of concrete were set between the stone and the base blocks.

The thickness at the base is seven metres, and this is reduced by successive offsets to four metres at the level of plus one metre, where commences the concrete capping which has a mean thickness of 3.60 metres.

The foundation bed has been disposed with a slope of 0.02 towards the interior, on the supposition that the wall would assume the vertical after settlement of the front part of the foundation, loaded to 4.30 kilogrammes.

Each block setting has been placed with a slight set-back (0.10 to 0.05); the batter which resulted from the slope in the plane of the foundation, added to these set-backs, produced a distance of 0.70 between the verticals passing through the upper and lower crests. After settlement, and in less than a year, the wall is sensibly vertical. The precaution taken for the levelling of the foundation was necessary and, indeed, proved scarcely sufficient. The settlement movement, very pronounced, is explicable by the nature and forms of the fragments employed. These fragments came from a limestone quarry with thin bedding, giving parallel-pipeds with edges, too sharp and surfaces too regular for satisfactory consolidation under tipping.

The cost of the work, with the filling, amounted to 40,000 francs per lineal metre.

Capetown Harbour Development

Important Proposals

By the courtesy of the Authorities concerned, we are able to reproduce below the text of the Report, dated 8th April, 1937, by the Railways and Harbours Board, upon Harbour Improvements at Table Bay Harbour, addressed to the Minister of Railways and Harbours of the Union of South Africa, Capetown

THE following report is submitted in compliance with Resolution No. 2, Third Report of the Select Committee on Railways and Harbours, May, 1930.

In the draft Capital and Betterment Estimates submitted for the consideration of Parliament for the financial year 1937-38, the following provision is made for the extension of Table Bay Harbour:—

Description of Work	Estimated Cost £
(a) Construction of "E," "F," and "G" berths complete with shed and crane equipment, excluding land filling and dredging	773,268
(b) Construction of new random block mole ...	267,190
(c) Removal of existing mole	50,000
(d) Construction of temporary pile embankment ...	50,000
(e) Reclamation of land including filling behind new berths "E," "F," and "G"	1,120,386
Total	£2,260,844

Of the above amount it is estimated a total sum of £525,000 will be spent during the financial year ending 31st March, 1938.

The sections of work provided for comprise a substantial portion of a comprehensive scheme for the development of Table Bay Harbour.

The estimated total cost of the scheme shown on the plan is £5,977,599. The position is therefore that:—

(a) Provision is made in the draft Capital and Betterment Estimates for 1937-38 for the commencement of works at an approximate cost of	£2,260,844
(b) The cost of the remainder of the works to be completed in future years is estimated at	£3,716,755
Total estimated cost of the whole scheme	£5,977,599

The time which will be required to complete the sections of work estimated to cost £2,260,844, for which provision is made in the draft estimates for the year 1937-38, is approximately four years from the date of commencement of construction.

The following are the principal sections of the scheme which it is proposed to hold over for construction in future years, and the approximate cost thereof:—

Description of Work	Estimated Cost £
(a) Removal of rock eastwards beyond the end of berth "G"	199,379
(b) Quay walls: approximately 10,400-ft. equivalent to 12 additional berths	1,219,242
(c) Additional reclamation	152,158
(d) Surfacing of quays and drainage. Water supplies and electric light. Railway and crane tracks, roadways and storm water drainage	256,789
(e) Single storied cargo sheds (12)	125,893
(f) Cranes: 60 erected, complete	158,013
(g) New graving dock, complete	1,605,281
Total	£3,716,755

The time required to complete the whole scheme (including the new graving dock), if the work proceeds normally without special acceleration or serious interruption, is estimated at from eight to nine years.

During the last fifteen years the development of Table Bay Harbour was proceeded with in the new basin under what is known as the "modified southern scheme." This scheme originated in the year 1897, but owing to its magnitude and the heavy cost involved, the work was not commenced at that time. After the Great War it became evident that additional dock accommodation must be provided at Capetown, and in 1921 the whole position was re-examined by a special committee, with the result that the original proposals were curtailed and a modified scheme adopted, consisting of straight quays running east and west along the southern side of the widened south arm in the new basin, with a return knuckle quay extending in a southerly direction to a distance of approximately 900-ft.

Work on the "modified southern scheme" was commenced in the year 1924 and proceeded without interruption until the year 1931 when, owing to the depression, it was decided to suspend the full equipment of cranes and sheds on the new quays at the south side of the widened south arm, also to suspend completion of the construction of the quay and deep water berth at the 900-ft. knuckle, the latter being temporarily finished off as a rubble mound similar to the mole on the southern side of the basin.

On the 29th January, 1934, the Administration was informed by the Union-Castle Company of the Company's intention to build large new modern ships for the South African mail service, and was asked to consider the question of providing berthing facilities at Capetown to accommodate these vessels. In February, 1934, the Minister of Railways and Harbours advised the Union-Castle Company that the Administration would be able adequately to accommodate the Company's large new mail vessels within a period of three years. Immediately after this assurance was given to the Company, steps were taken to investigate the position, and several proposals were considered. These proposals were not in themselves new schemes of harbour extension, but were, in effect, alternative methods of proceeding with the further internal development of the modified southern scheme in the new basin.

The scheme recommended by the Administration's technical officers was to construct two new deep water berths on the west side of the new basin in which large vessels could be accommodated lying head on to the prevailing south-easterly winds. This proposal which became known as Scheme "F," was submitted to the Administration by the General Manager on the 21st June, 1934, by which time, however, the Nijhoff Harbour Commission had been appointed and the Administration's decision was, in consequence, postponed.

The Nijhoff Commission's report on Table Bay Harbour was presented to the Minister in November, 1934. The report contained proposals which were unacceptable and as time was becoming limited in which to implement the Administration's undertaking given early in 1934 to the Union-Castle Company to provide suitable berthage within a period of three years, the Administration decided to fully equip with cargo sheds, cranes, new precooling facilities, etc., "C" berth on the straight quay wall in the new basin and to complete the south arm return knuckle berth, also fully equipped, as originally designed under the "modified southern scheme." This was done and the safe berthage of the new vessels within the time promised was thereby assured.

On the 17th July, 1935, a deputation representative of the Capetown Chamber of Commerce interviewed the Minister of Railways and Harbours with regard to harbour development at Capetown. It was contended by the deputation that all-weather deep water berthage should be provided at Capetown additional to the new south arm return knuckle berth, and that steps should be taken to proceed with the construction of the berths provided for under the "F" scheme. The Minister informed the deputation that a comprehensive scheme would be put in hand for the future development of Table Bay Harbour, with special provision for additional all-weather berthage for big ships.

On the 1st/2nd November, 1935, a comprehensive report and preliminary plan were submitted by the Administration's Chief Civil Engineer. The proposals made by the Chief Civil Engineer were identical in principal with the scheme shown on the Plan.

The Chief Civil Engineer's proposals were placed before the Table Bay Harbour Advisory Board and were considered at a special meeting of the Board held on the 14th November, 1935, as a result of which the following Resolution was passed:—

> That the Board records its agreement, in principle, with the report submitted by the Chief Civil Engineer on behalf of the Administration. The Board would emphasize the urgency of proceeding with the construction of berths "E" and "F" under scheme "F" to provide accommodation in Table Bay Harbour which present-day requirements demand;
>
> The Board further expressed the opinion that the construction of the new berths "E" and "F" was of such urgency that construction work should be commenced at the earliest possible date. To this end it is considered a rock-breaker should be ordered at once and that block-making should not be interrupted upon completion of the present block-making for the Knuckle berth.

An inspection was carried out by the Railways and Harbours Board on the 18th February, 1936, with the result that the Administration decided, in the light of the further consideration given to the matter, to authorise the construction of the first

Capetown Harbour Development—continued

berth on the west side of the new basin under Scheme "F" at an estimated cost of £391,654; provision was made accordingly in the Capital and Betterment Estimates for the year 1936-37. This is also the inside berth "E" under the comprehensive scheme now under consideration.

Towards the end of the year 1936 the Chief Civil Engineer and the local Harbour Authorities at Capetown made further representations in regard to the extremely congested state of the Table Bay Harbour area and the lack of room for further expansion, the effect of which was causing serious interference with the efficient operation of the port. This state of affairs was brought about by increased traffic, particularly petrol and oil, the crowding out of vessels hitherto using berthage in the Victoria Basin and the all-round larger class of ships now using the port. For these reasons it was urged that the scheme of developments in the new basin should be taken in hand on a more extensive scale than present authorities provide, also the progress of the work in the immediate future should be accelerated.

Petrol and Fuel Oil Landed.

	Tons
Calendar year 1933	179,169
Calendar year 1934	185,367
Calendar year 1935	287,396
Calendar year 1936	498,874

Tonnage and Number of Ships.

Financial Year	Ships	Gross Tonnage	Cargo Tons
1932-33	1,545	6,556,367	1,304,128
1933-34	1,669	6,929,570	1,297,127
1934-35	1,960	8,394,897	1,675,538
1935-36	2,353	9,860,272	1,938,058
1936-37	3,157	11,318,639	2,128,315

Table Bay Harbour: Earnings.

1932-33 ...	£278,414
1933-34 ...	£337,060
1934-35 ...	£392,520
1935-36 ...	£440,878

The congestion caused by the heavily increased traffic reflected by the foregoing statistics will not be adequately relieved by the completion of the new berths "D" and "E"; a large area of new ground for expansion of shore facilities is required, to obtain which extension of the "F" Scheme line of quays is unavoidable.

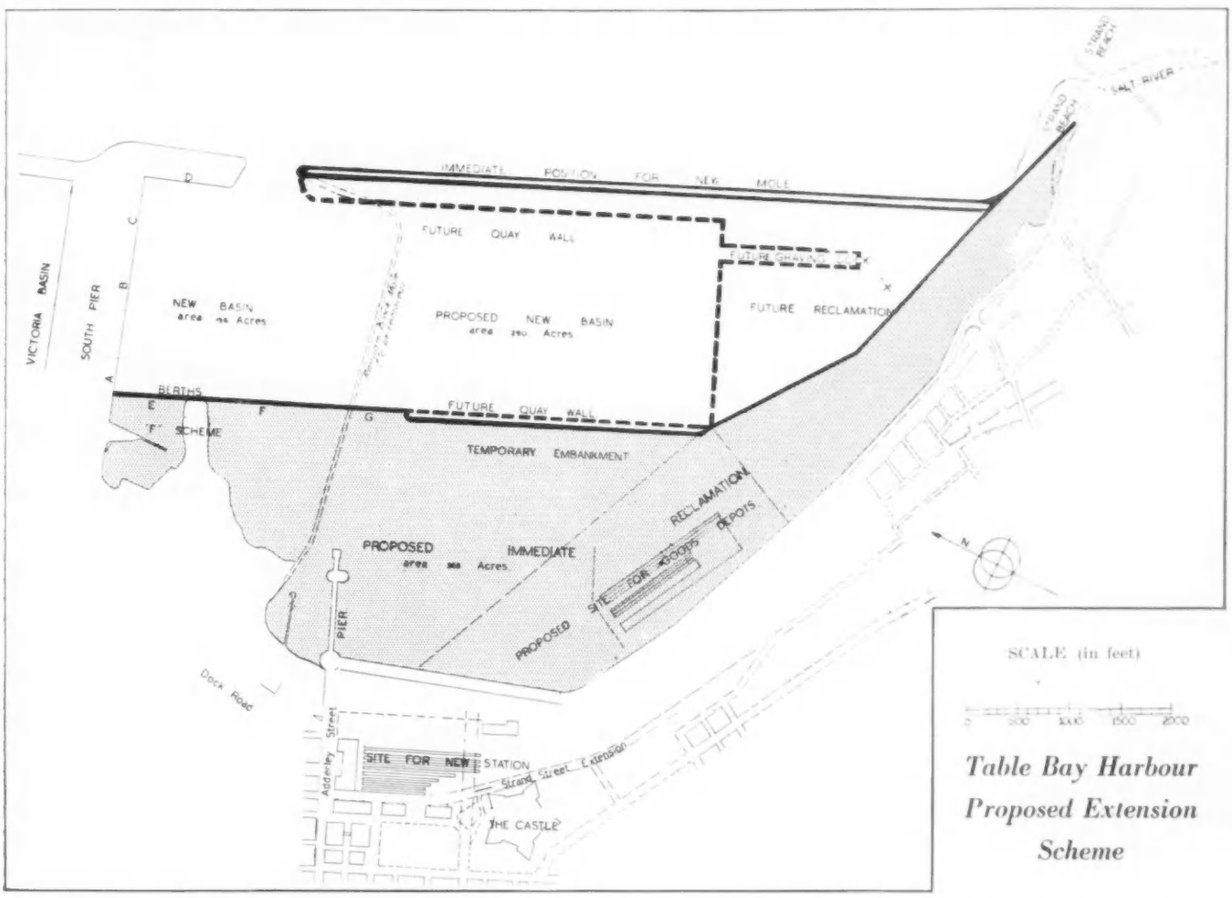


Table Bay Harbour Proposed Extension Scheme

From an engineering point of view it was represented that if a definite programme of work is not laid down of sufficient magnitude and extending over a comparatively long period, the most economical methods of construction cannot be employed, possibly including large scale contracts with firms who will provide their own plant.

The following particulars are furnished in support of the proposal to proceed at once with the comprehensive scheme for the development of Table Bay Harbour to the extent indicated on the plan annexed hereto.

Growth of Traffic

Tables showing the growth of traffic at Table Bay Harbour during recent years are given below:—

Tonnage of Cargo Handled.

	Tons
Calendar year 1933	1,309,103
Calendar year 1934	1,545,284
Calendar year 1935	1,901,451
Calendar year 1936	2,050,123

General Cargo Landed.

	Tons
Calendar year 1933	806,372
Calendar year 1934	891,387
Calendar year 1935	971,647
Calendar year 1936	1,099,912

Loss of Berthing Accommodation

A serious disability which must be met in the immediate future is the loss of berthing accommodation in the Victoria Basin for ocean-going vessels of ordinary dimensions. Generally, the ships now using Union ports are larger, lengthier, and of deeper draught than formerly; consequently berths such as Nos. 1, 2, 3, and 4 on the South Arm, Victoria Basin, are no longer able to accommodate four vessels together as at one time was the case.

The transfer of the fishing harbour from the new basin to the Alfred Basin to make room for the construction of berth "E" will seriously reduce the sum total of the available berthage for ordinary shipping at Capetown. The total number of berths for shipping at Table Bay Harbour is at present seventeen. Completion of "D" and "E" berths will bring the number up to nineteen. With the transfer of the fishing harbour to the Alfred Basin, the North Quay, the Rest Quay, the Basin (which includes Nos. 4 and 5 Quays), No. 8 Quay, and the north side of the Collier Jetty will be occupied by fishing craft, whale-catchers, departmental craft, etc., which will reduce the total number of available quays to fourteen. The transfer of

Capetown Harbour Development—continued

the fishing harbour from the new to the old basin will, therefore, cause a serious reduction to the berthage available at Capetown.

Adverse Weather Conditions

With the occupation of the Alfred Basin by fishing craft, larger vessels which hitherto used that Basin will be forced into the Victoria Basin, and this will in turn force still larger ships into the new basin. Under existing conditions the berths along the South Arm in the new basin are not entirely satisfactory for berthing and unberthing larger vessels during heavy south-easterly gales. For large ships such as the "Stirling Castle" and the "Athlone Castle" there are at present only two suitable berths available in the Victoria Basin, and there is very little margin of safety when swinging these vessels in that Basin even in the best weather conditions. Completion of berths "D" (Knuckle) and "E" in the new basin will improve matters, but with the almost continual occupation of these berths by large mail ships, there is little margin for other ships. From a nautical point of view additional all-weather deep-water berthage should be provided in the new basin, capable of accommodating the largest types of ship in the South African trade.

Petrol and Fuel Oil Storage

The possibility, under present conditions, of finding adequate and suitable ground area for expansion of the petrol and crude oil bulk storage industry, is one of the most difficult problems with which we are confronted in the Capetown Harbour area. The position is acute, and until the Administration's policy regarding the main harbour development scheme is known and the rate of future progress is laid down, it is not possible to furnish the oil companies with a satisfactory reply to their repeated inquiries as to how and when their bulk petrol and oil storage accommodation in the Table Bay Harbour area can be extended. The only feasible solution of the difficulty is to provide, at the earliest possible date, sufficient reclaimed ground behind the line of quays at the "F" Scheme upon which to re-erect the grain sheds now situated at the back of the Quarry in the Victoria Basin area and thus release space in that area for lease to the oil companies.

New Graving Dock

The complete scheme of harbour development at Capetown includes provision on the south-easterly side of the enlarged new basin for a large new graving dock. Whilst it is true that Table Bay Harbour is without graving dock facilities for large ships, present-day conditions and early future requirements do not justify the immediate provision of the new large graving dock in the position indicated on the plan.

Improved Goods and Passenger Yard Lay-out at Capetown

Although not entirely interdependent the question of improved goods and passenger yard layout at Capetown is connected with the enlarged scheme of harbour development at that port, and it is desirable both from financial and practical points of view that the two schemes should be linked together because of the reclamation work involved, which on economic grounds should be regarded as common to both.

Recommendation

The new proposals have received the careful consideration of the Administration's Technical and Executive officers concerned. The scheme has also been accepted by the Table Bay Harbour Advisory Board. It is not possible at the present time to frame an estimate of the financial benefits which will accrue when the complete new scheme is placed in commercial operation, but from general commercial and economic standpoints, as well as in the interests of the efficient handling of the heavily increased traffic at the port and the provision of adequate shore space for future expansion, the Board is satisfied that the advantages which will be gained, fully justify the adoption of the comprehensive scheme of development at Table Bay Harbour set out on the Plan and recommends accordingly. The Board also recommends that the portions of the work, estimated to cost £2,260,844, for which provision is made in the draft Capital and Betterment Estimates for the financial year 1937-38, be put in hand immediately these estimates have received the approval of Parliament.

Excerpts from Report of the National Harbours Board of Canada for Year 1936

In conformity with Section 32 of the National Harbours Board Act, 1936, the Annual Report of the National Harbours Board covering the operations of the harbours of Halifax, St. John, Chicoutimi, Quebec, Three Rivers, Montreal and Vancouver was submitted for the calendar year 1936. During the first nine months of the period separate corporations existed for each of the harbours, the Commissioners in each case being three officers of the public service at Ottawa. On October 1st, 1396, with the proclamation of the National Harbours Board Act, the former corporations were succeeded by the National Harbour Board.

Traffic

The volume of traffic moving through and at the ports under the jurisdiction of the Board recorded advances in line with the general economic recovery experienced during 1936.

The following is a summary of the traffic of the harbours under the jurisdiction of the Board:—

The total number of vessels arriving and departing is reported as follows:—

Calendar year 1936	73,038 vessels	
,, 1935	69,866 ,,	
an increase of	3,172 ,,	
or	5%	

The net register tonnage of vessels arriving and departing is reported as follows:—

Calendar year 1936	67,316,144 tons	
,, ,, 1935	63,365,130 ,,	
an increase of	3,951,014 ,,	
or	6%	

In order to make the comparisons some slight adjustment of 1935 figures has been necessary.

The volume of cargo tonnage landed and embarked by vessels arriving and departing is reported as follows:— (Tons 2,000 lbs. W. or M.).

Calendar year 1936	27,770,875 tons	
,, ,, 1935	24,436,046 ,,	
an increase of	3,334,829 ,,	
or	13%	

Revenues and Expenditures

Operating revenues in 1936 for all ports amounted to $8,030,600, as compared with $7,427,454 in 1935, an increase of $603,146, or 8.1 per cent. Operating and maintenance expenses aggregated $4,494,713, as against $4,975,755 in 1935, showing a decrease of $481,042, or 9.7 per cent. After taking into account miscellaneous income, the net amount available for interest and depreciation was $ 3,601,346, as compared with $2,473,261 in 1935, an increase of $1,128,085, or 45.6 per cent.

After provision for interest, replacement reserves, etc., the net income deficit for the year was $5,876,582.

Reserve for replacements charged in the 1936 accounts amounted to $1,907,179, as compared with $788,359 in the previous year, thus increasing the net income deficit. A charge for this purpose has now been made for each of the harbours, whereas in 1935 only the Harbour of Montreal included any reserve for replacement of physical assets. In the case of harbours other than Montreal the charge is an approximate one, as in the short time since assuming office the Board has not had the opportunity of making a detailed survey and valuation of properties with a view to determining definitely the amount which should be provided under this heading.

All harbours participated in the improvement in operating revenues and in the reduction of operating and maintenance expenses as compared with the previous year.

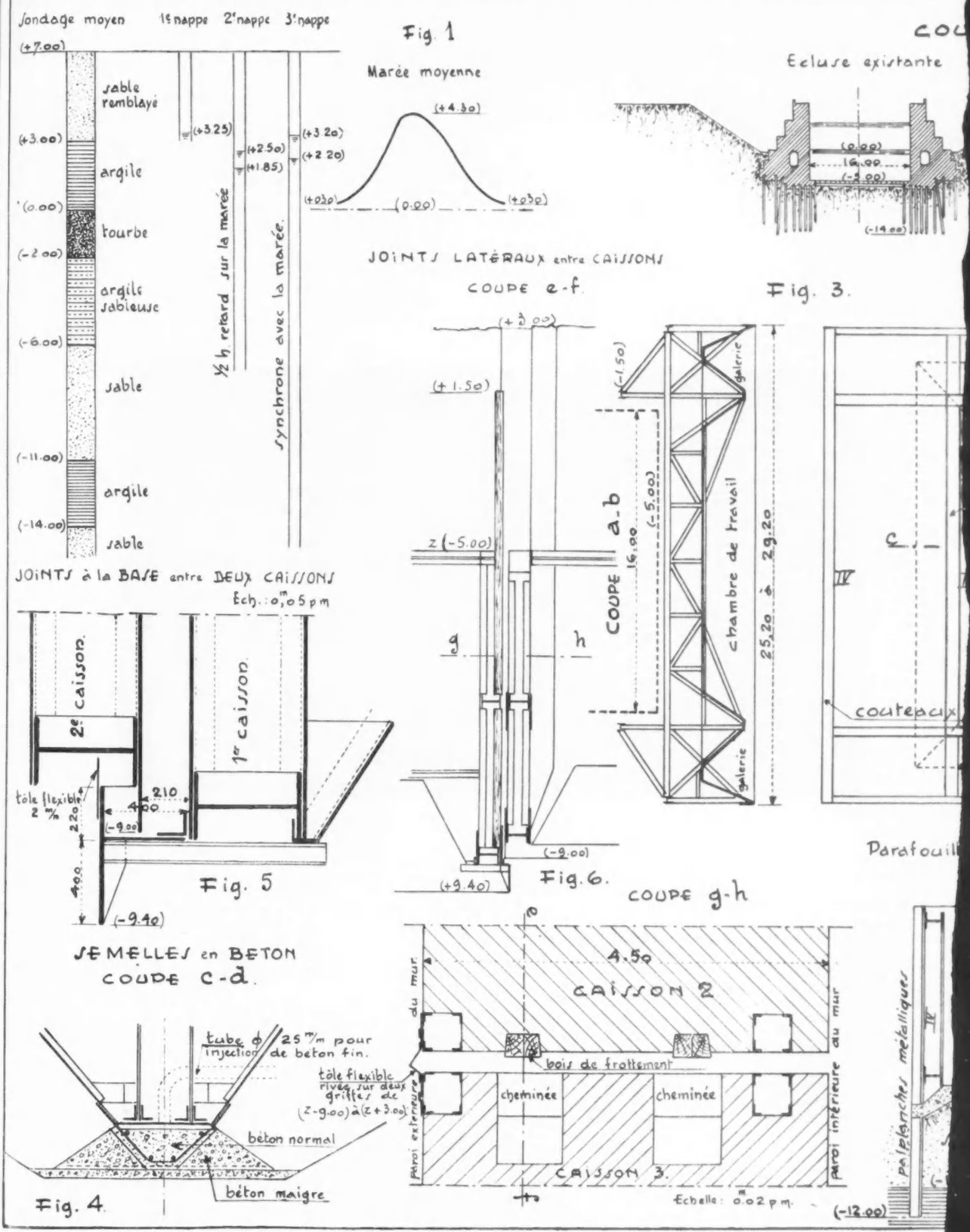
The cash deficits of $14,934 at Halifax, $20,141 at Saint John, $212,802 at Quebec, $1,840 at Chicoutimi and $443,000 for the Jacques Cartier Bridge, Montreal, have been paid to the Board out of the Consolidated Revenue Fund of Canada. The net earnings of the other harbours have or will be applied to payment of interest due to the Government, after provision for replacement reserves.

The Report was signed by three officers of the National Harbours Board, Messrs. R. O. Campney (Chairman), A. E. Dubuc (Vice-Chairman and Chief Engineer) and B. J. Roberts (Member).

New Grain Elevators at Argentine Ports.

A contract of the value of £676,000 for the construction of grain elevators at four Argentine ports, has been awarded to Henry Simon, Limited, of Stockport. The order is for the first of three groups of elevators to be built under a four years programme estimated to cost £7,000,000.

New Lock of the Oste



TRANSLATION OF FRENCH WORDING ON PLAN.

Fig. 1.

Sondage moyen	= Average ground test
Nappe	= Water table.
Sable remblayé	= Embanked sand.
Argile	= Clay.
Tourbe	= Peat.
Argile sableuse	= Sandy clay.
½ h. retard sur la maré	= ½ hour later than the tide
Synchrone avec la marée	= Synchronous with the tide.
Marée moyenne	= Average tide.
Joints à la base entre deux caissons	= Joints at the basis between two caissons.
Tôle flexible	= Flexible plating.

Fig. 2.

Coupe transversale Sud-Nord	= Cross section South-North
Ecluse existante	= Existing lock.
Ecluse nouvelle	= New lock.

Fig. 3.

Joints latéraux entre caissons	
Chambre de travail	
Couteaux portants	
Couteaux extérieurs	

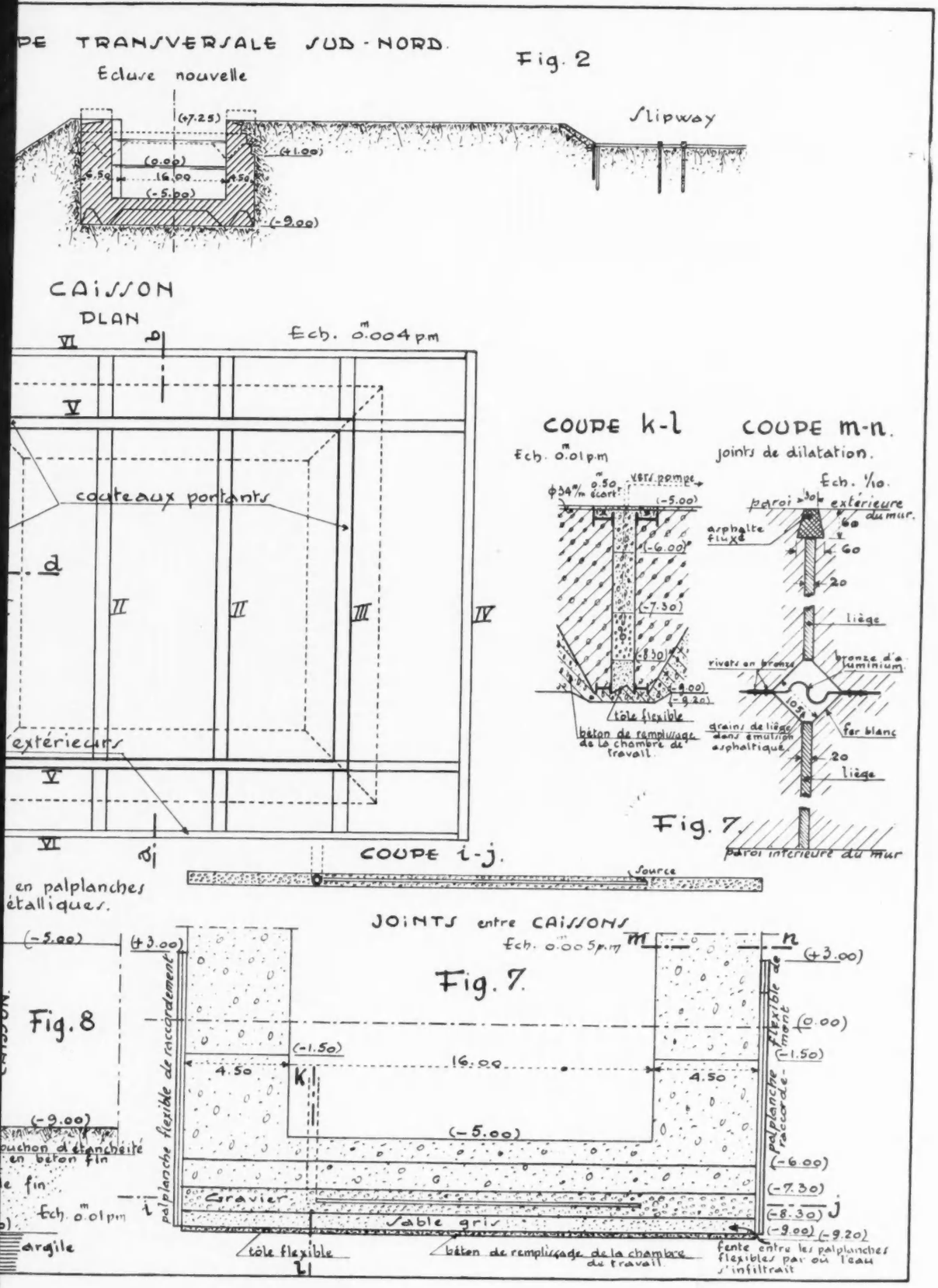
Fig. 4.

Semelles en béton	
Coupe	
Tube 25 mm. pour injection de béton fin	
Béton normal	
Béton maigre	

Fig. 6.

Tôle flexible rivée sur deux griffes	
Bois de frottement	
Cheminée	
Paroi intérieure du mur	

d Fishing Harbour



ral joints between caissons.
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ible plate rivetted on two claws.
ion-timbering
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r facing of the wall.

Fig. 7.

Vers pompe	=	To pump.
Tole flexible	=	Flexible plate.
Béton de remplissage de la crambre de travail	=	Concrete fill of the work chamber.
Joints de dilatation	=	Expansion joints.
Ecartement	=	Distance.
Paroi extérieure	=	Outer facing.
Asphalte fluxé	=	Fluxed asphalt.
Liége	=	Cork.
Rivets en bronze	=	Bronze rivets.
Grains de liége dans émulsion asphaltique	=	Cork grains in asphaltic emulsion.
Fer blanc	=	Tin plate.
Palplanche flexible de raccordement	=	Flexible sheetpile for binding.
Sable gris	=	Grey sand.
Fentre entre les palplanches Flexibles, par ou l'eau s'infiltrait	=	Chink between the sheetpiles, through which the water filtered.

Fig. 8.

Palplanches métalliques	=	Steel sheetpiles.
Bouchon d'étanchéité en béton fin	=	Water-tighting plug in thin concrete.

New Lock of the Ostend Fishing Harbour*

By M. VERSCHOORE

Ingenieur en chef, Directeur des Ponts et Chaussees, Service special de la Cote, Ostende

THE new installations of the Ostend fishing harbour were described in an article which appeared in the August, 1935 number of the "Annales des Travaux Publics" and announced the construction of a new lock, which is now in course of being built.

The study of the project for this structure was governed by the nature of the subsoil and the manner in which the ground behaved during the construction of the lock already built.

The subsoil mainly consists (fig. 1) of three layers of sand separated successively — starting from the surface — (general level of the ground: + 7.00 above the Ostend zero) by a layer of clay, peat and sandy clay extending from (+ 3.00) to (— 6.00), and a second layer of mixed clay extending from (— 11.00) to (— 14.00).

The lower layer of sand rests on Yprian clay of which the bottom is found at the level (— 33.00).

View inside caisson nr 3, between beams III and IV, downstream.

To each of the layers of sand there is a corresponding water table, the level of the first remaining practically constant at (+ 3.50); the second varies with the tide, but half an hour later than the latter, from (+ 1.85) to (+ 2.05); the third also varies under pressure from the tide, at the same time as the latter, from (+ 2.20) to (+3.20).

The upward pressure at the base of the lower layer of clay (level: — 14.00) is therefore on the average at a depth of water of 16 m. 70.

Fig. 2 shows a cross-section of the lock already built.

The excavations planned for the construction of the existing lock were to go down to the level (— 8.00). When the level (— 6.00) was reached the layer of clay burst upwards, owing to the lightening of the weight of the soil above it.

No less than 12 springs, practically uniformally spread over the area of the existing lock, and of which the mouths had a diameter of 3 to 8 m., appeared and spurted for 50 days pouring out a volume of sand estimated at over 6,000 m³.

These escapes of sand caused the builders to fear the existence of runnels in the layer of Yprian sand and of subsidences of the layer of clay between (— 11.00) and (— 14.00), alongside the site of the existing lock.

The latter, founded on soil apparently improved by a later lowering of the water by means of filter-sumps, but whose resistance was found to be much lessened owing to the existence of the twelve spring-outlets imperfectly filled up, began to settle, causing cracks in all directions, through which the seawater worked into the concrete mass and commenced its work of disaggregation.

The cross-section of the existing lock shows that the foundation piles 7 m. 50 long have in reality no proper seating in the layer of Yprian sand, their tips being at the level Z—14.00.

The state of the ground was again studied with a view to the construction of the new lock, by soundings, by observation of the hydraulic gradient of the water tables and by the ramming of test piles.

Confirmation of the possibility of subsidences of the layer of clay between (— 11.00) and (— 14.00) was obtained during the sinking of an observation sump in which the tube was sunk to the level (—14.00): the water suddenly rose, as if under the impulse of a ram, to the level of the ground, i.e. 4 m. 00 above the normal hydraulic gradient of the lower water table.

On another hand, the permanency of the effects of the production of the "chimneys" in the layer of clay was brought to light by an attempted ramming of a pile by means of a water jet.

A 30 × 40 cm. reinforced concrete pile rammed to the level about (— 7.00), the earth surface being at the level (+ 4.00) and the pile thus having a seating of 11 m., only sank 1.5 cm. after a series of 30 blows. Applied to the plant used, the Dutch formula having a coefficient of safety of 2 meant that this pile had a bearing strength of 480 tons.

As this pile was to serve as a load-test for a minimum seating of 5 m. 00 below the level (— 6.00), viz. that its tip was to go at least to the level (- 12.00), it was decided to facilitate its sinking by using a water jet.

This jet was forced down to (— 14.00) and caused the two water tables to communicate with one another, doubtless giving rise to an ascending flow of water; suddenly the pile sank under its own weight more than 4 m. 00 down to the level (— 11.135).

After 24 hours rest the ramming still only gave a refusal of 28 cm. per series of 30 blows or, still according to the Dutch formula, a bearing strength of 26 tons.

After 6 weeks rest a static test showed an effective load limit of 50 tons, or practically 25 tons if one adopts a safety factor of 2.

If reference is made to the plan of the installations of the Ostend fishing harbour (see "Annales des Travaux Publics," August, 1935) it will be noticed that the only possible site for the new lock is immediately to the north of the existing lock.

The problem was therefore set with the following data:

Broken up subsoil, water tables under pressure, the immediate vicinity of the existing lock threatening to break up, but the use of which had to be maintained at all costs, at any rate until the new lock could be put into service.

These facts made it necessary to make a solid floor forming an unbroken mass with the chamber walls.

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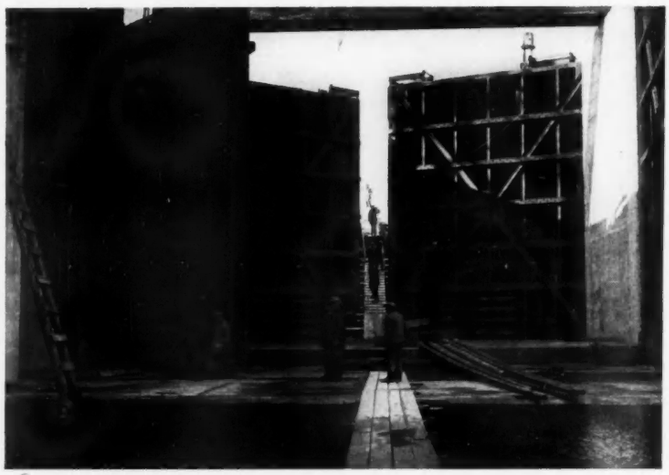
* Reproduced by permission from the Bulletin of the Permanent International Association of Navigation Congresses (January, 1937).

New Lock of the Ostend Fishing Harbour—continued

As to the method of executing this work, the lowering of the water tables by stages would certainly have been suitable, if we had not feared that the pumping would cause water to appear all round the structure and consequently beneath the foundations of the lock already in existence. Even a screen of sheet piling separating the two structures would not quite set our minds at rest, unless we went down to unreasonable depths. Even the proposal by the Franki Pile Co. to build behind a frozen wall did not appear suitable; this Company considered they could not give any guarantee unless the frozen walls were sunk as far as the layer of Yprian clay, viz., a depth of 40 m.

We considered that the method of construction that would give the greatest guarantee, and in the end the cheapest method, would be to make the foundations without disturbing the equilibrium of the various strata of soil and water tables through which we should have to work down, viz. by founding the new structure by means of compressed air caissons.

The lock is divided into four caissons: one for the downstream head measuring 36 m. 50 × 29 m. 20, two of 33 m. 35 × 25 m. 20 for the chamber properly speaking and one for the upstream head of 33 m. 50 × 29 m. 20, sunk to the level (— 9.00) (fig. 3).



View of the mitre gates.

The floor is 4 m. 00 thick and is so calculated that the metal framework forms the single resistant element, the concrete only intervening as a filling.

Six transversal lattice-work beams about 4 m. high take up the stresses caused by upward pressure, once the lock is in place, and the stress due to efforts transmitted during the sinking, this being chosen from among a whole series of hypotheses, among which one was considered: to let the compressed air in the working chamber escape suddenly; in this latter case the rate of the working of the steel was increased to 1,600 kg./mm². Normal rate = 1,200 kg./mm².

These transversal beams rest on two main longitudinal beams, of lattice-work, having a height of 7 m. 50 and rising in the chamber walls of the lock to a height of 3 m. 50. They ensure, concurrently with the reinforcement, solidarity between the floor and walls.

These main beams are 21 m. 00 apart from each other, whereas the transversal beams have a length of 29 m. for the caissons of the heads and 25 m. for the caissons of the chamber walls.

The lower soles of the longitudinal beams form, together with the soles of two intermediary transversal beams the bearing edge.

The butt-ends of the transversal beams are connected by a beam 4 m. 00 high and constitute with the shore transversal beams a second knife blade running round the outer circumference of the caisson.

This arrangement, creating a rectangular main working chamber and a tunnel working chamber all round the former, both moreover in communication with one another, gives the following advantages: greater rigidity of the framework, greater security for the sinking, easier regulation of the sinking.

Thanks to the multiplicity of the lateral oblique surfaces of the working chamber, the increase of the bearing surface during sinking is clearly much more rapid than with the system of caisson only comprising a single knife-edge around.

This advantage is above all appreciable, and was moreover proved, in the case of accidental sudden sinking.

Principal bearing knife-edge.—The caissons were erected (at the level + 1.00) on reinforced concrete soles, of which the stirrup irons are welded to the lower rail of the main beams.

By lowering the concrete of these slightly reinforced soles on the two sides we created beneath the main beams a wedge forming the knife-edge properly speaking (fig. 4).

Joints between Caissons

Watertightness at the base of two caissons next to each other is effected as follows: (fig. 5).

The lower rail of the shore beam of the caisson sunk in the first instance runs down to the level (— 9.00). It is prolonged towards the outside by a horizontal projection of 400 mm., which ends in a vertical plate 400 mm. wide, suitably stiffened, forming the knife edge properly speaking, and consequently running down to the level (— 9.40).

The following neighbouring caisson is theoretically sunk at a distance of 210 mm. from the preceding caisson.

On the other hand, the lower rail of the shore beam of the second caisson goes down to the level (— 8.88) and has its outer plate prolonged vertically 220 mm., so that it rests at the level (— 9.00) on the projecting knife blade of the first caisson.

If the sinking is done vertically it suffices to weld the vertical plate of the second caisson to the horizontal plate of the knife edge of the first caisson.

In case the second caisson should sink away from the first caisson, the projecting knife blade of the latter is in addition provided with a flexible plate 2 mm. thick, which can be so bent as to come into contact with the outer knife blade of the second caisson.

The extremely short delivery date and the fact that the contractor preferred not to concrete the chamber walls within the metal casings left in the ground obliged him to exaggerate the weight of the caissons at the start and to support the outer knife edge on wooden sleepers. It happened that in the case of the first caisson sunk—the caisson of the upstream chamber—the sleepers under the outer knife edge could not all be removed in time.

Finally these sleepers were cut off and they pressed back the projecting elongation of the blade, bending it back against the outer wall of the caisson.

The welding of the plates of the caisson of the upstream chamber and of the caisson of the upstream head could thus not be done. The horizontal joint between the two caissons was made watertight by prolonging the concreting of the working chamber of the caisson of the upstream head, beneath its outer shore blade, until it touched the shore beam of the caisson of the neighbouring chamber.

The lateral joints along the vertical are filled by sheet piling consisting of a flexible plate welded to two claws which were rammed and thus engage these claws in two claws previously fastened to the but-ends of the caissons (fig. 6).

It will be noticed that the horizontal assemblies between the butt-end blades of the caissons and the flexible sheet piling, which form a welding of the lateral walls, have, where they meet, a slight continuity; it was thought that it sufficed to leave an earthen plug at the angles of the joints to prevent water from entering, at any rate in such large quantities that the hollowing of the joints and their concreting might have caused difficulties.

As a matter of fact, as soon as the excavation reached three quarters of the thickness of the floor the springs of water passing through the angles of the joints increased to such an extent that the filters placed immediately outside the joints were inoperative.

To avoid sand from being displaced from beneath the foundation the last layer of soil from 0 m. 70 to 1 m. 00 thick was left in its place (fig. 7).

On this layer a gravel bed was laid 0 m. 50 thick, in which was embedded a filter tube leading to a pump whose continuous action enabled the water level to be maintained below the level of the gravel.

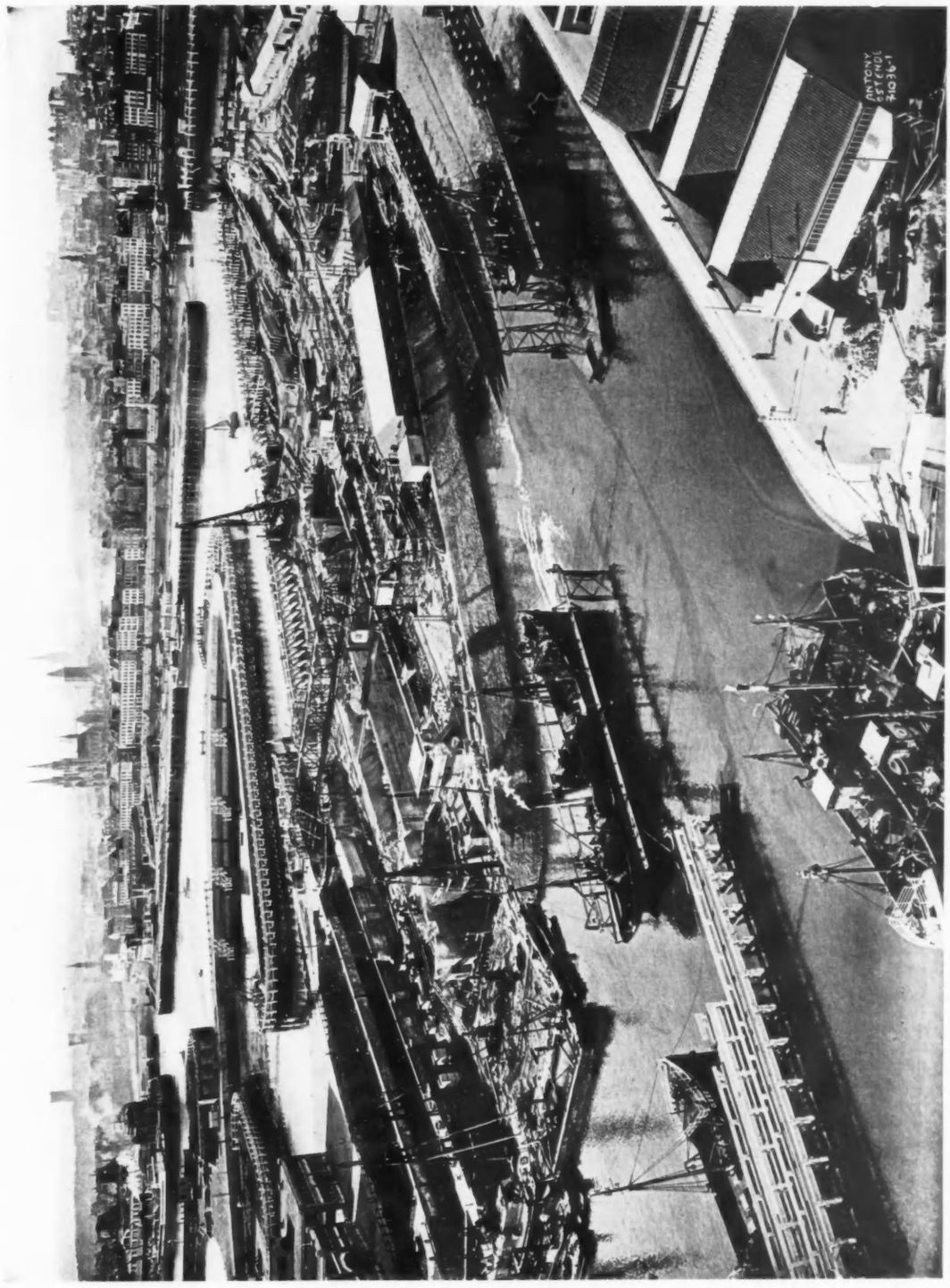
After having ensured, by welding, the continuity from one caisson to another, of the longitudinal reinforcements of the floor, it was possible to concrete the joint of the floor in the dry to a thickness of 2 m. 50.

The jointing of the concrete filling with the concrete of the caissons was moreover assured by notches made for the whole height of the butt-end walls of the floor, by vertical access-chimneys rising to the whole height of the chamber walls, as well as by hollowings left after removal of the wooden friction-liners.

The floor was kept dry for six weeks and proved to be absolutely watertight.

From the level (— 1.50) up to the summit of the chamber walls, the joints between caissons are arranged as expansion joints, on the lines shown in fig. 7. In between, similar joints have been placed in the chamber walls in the middle of caissons II and III of the chamber.

New Lock of the Ostend Fishing Harbour—continued



General view of the Port and of the Building Yard of the New Maritime Lock at Ostend.
In the left corner, above: the Maritime Station; below, the north corner of the new Fishmarket; then, from left to right: Old Lock, New Lock in building, Slipways for 1,000 and 500-ton boats. In the foreground: Fishing Harbour.

We considered that the effects of temperature would not make themselves felt at lower depths, as the water in the lock never drops below (0.00). In addition, the presence of the longitudinal beams of the caissons and of the reinforcements placed as far as (— 2.00) made such joints unnecessary and impracticable.

The head walls have no joints, owing to the appliances for sluicing and working the gates and owing to the reinforcements they contain.

Sinking of the Caissons

Retaining of the soil upstream and downstream from the caisson during sinking was done by means of screens of metal sheet piling supported below by the shore beams of the caisson and leaning above against the chamber walls through five sets of rolled beams 1 m. 00 high.

Each caisson contained 3 shafts giving access to the working chamber, two of them being fitted with electric goods-hoists.

The latter are used solely for the peat excavated and for clearing away the timber and concrete after demolishing the soles.

The excavations were made in the wet, first using a centrifugal pump for the sand and then the mammoth pump when the pressure is sufficient in the working chamber to allow of raising the emulsioned mixture of water and sand.

When sinking was began, the floor was concreted above the working chamber, as also the chamber walls to a height of 3 m. 50. The caissons then weighed 5,000 tons for the chamber caissons and 6,500 and 7,500 tons respectively for the upstream and downstream heads.

In this weight is comprised the metal framework of the floor, to the extent of 480 tons for the chamber caisson and 600 tons for the head-caissons.

The erection of the caissons took eight months and entailed the placing of 250,000 rivets.

Sinking of the caissons took 62 days for caisson No. III, 47 days for caisson No. I, 25 days for caisson No. IV, and 45 days for caisson No. II, or in exactly 7 months including the passage from one caisson to another. The sinking is all the more rapid when the layers to be traversed are more sandy, as the waste is easier to dilute. Average progress: 18 cm. a day in clay and 35 cm. in sand

New Lock of the Ostend Fishing Harbour—continued

A few particulars of the lock:

At each head there has been arranged a cut-off of metal sheet piling running down to the level (- 12.00) in the layer of clay above the Yprian sand (fig. 8); with a view to avoiding the placing into communication of the two subterranean water tables separated by the layer of clay, it was specified that these screens of sheet piling should be rammed, without the use of water jets.

The facings are of plain concrete; the sills, placed at the level (- 4.50) are of cast steel; the downstream head comprises a sluicing device placed for the purpose of freeing the floor from mud by means of tewels opening out into the chamber from the gates and in the foot of the mitre sill; the mitreing-gates are metallic, welded; filling and emptying of the lock are done by sluices in the gates.

The entrance channel is bordered by quay walls of the Chistiani & Nielsen type having anchorages.

The concrete consists of 400 kg. of metallurgical cement, 450 litres of 0/5 mm. sand and 750 litres of 5/30 mm. gravel. Tests made beforehand showed that the most compact and resistant concrete was obtained by using a mixture of 1 part in volume of sand from the sandhills and 3 parts of Rhine sand.

The modulus of fineness of the sand from the sandhills is about 0.8 to 0.9. For the Rhine sand used it is from 2.5 to 3.

The undertaking awarded to the contractor Delens, Ingénieur A.I.G., and amounting to about 23,000,000 francs, comprises the preparation of 45,000 m³ of concrete almost entirely reinforced; the supplying and erecting of 3,660 tons of steel was confided to the Ateliers Métallurgiques de Nivelles.

For the sinking of the compressed air the contractor called upon the collaboration of the firm Wayss & Freytag of Frankfort o/M.

Organisation of the Site of Works and Plant

The materials are brought to the site of the works by water and by rail. The unloading capacity per boat is 700 tons a day.

There have been laid down 6 km. of 600 cm. track and the storage capacity is 15,000 tons of gravel and sand.

A steam crane fitted with a 1,000 litre grab feeds three moveable mixer-silos on rails, of which one contains 20 m³ for the sand from the sandhills and two hold 50 m³: one for gravel and the other for Rhine sand.

The capacity of the cement sheds is 1,200 tons.

Two Diesel locotractors serve to carry the materials for the concrete and four steam locomotives for the earthworks, and two for unloading.

Three Diesel grabs on caterpillars are used for the earthworks on discharge from the steamers, carrying the reinforcements, etc.

A metal pile driver on rails 27.50 m. total height, fitted with a drop-hammer weighing 6,300 kg. serves to ram the sheet piling and reinforced concrete piles. It is the largest machine of its type at present in existence in Belgium.

There are also available two French moveable pile drivers having a hammer weighing 3,500 kg. for the ramming of metal sheet-piles and certain reinforced concrete piles, two Dutch pile drivers having a 1,100 kg. hammer and a 180 ton pontoon equipped with a French pile driver mounted on shears.

A 500 litre concrete mixer serves for concreting the quay walls.

For building the lock the contractor has a movable transporter bridge having a span of 47.50 m. and a 6 m. overhang constructed for a load of 6 tons; intermediate supports enable this load to be increased to 12 tons, which is the weight of the compressed air bells.

Two concrete mixers holding 1,500 litres and running on rails placed parallel to the axis of the lock can mix 25 m³ each an hour. Working 24 hours, the quantity of concrete put in place can easily reach 1,000 m³ a day. The portal bridge, fitted with grabs holding 2 m³, deposits the concrete at the desired spot.

Compressed air is supplied by five rotary compressors and a horizontal compressor supplied with current by the town; four of these compressors can be worked by two electric-generating sets of 120 and 150 h.p. and one direct by the Diesel motor.

An electric sub-station comprising four transformers of 200 kva transforms the current from the town from 11,000 to 220 volts.

In order to ensure complete safety as regards the pumping out of the excavation in which the caissons are erected, the contractor has installed two centrifugal pumps of 200 mm. electrically driven and one of 150 mm. driven by a Diesel engine, as reserves. One 80 mm. pump and one 60 mm. pump suffice to maintain the excavation dry in normal weather. On the other hand, the requisite plant for an eventual lowering of the water table is at hand in the workyard.

St. Lawrence Navigable Channel and the Port of Montreal

The navigation difficulties arising out of low water levels in the channel of the St. Lawrence and the approach to the harbour of Montreal led to the appointment three years ago of a Board of seven engineers to study the problem of providing better accessibility. The report of the Board has recently been submitted to the Canadian Government and it is to be gathered from the Montreal press that there is a majority report of five members, with independent minority reports from the other two members. The majority report recommends the adoption of an extensive dredging programme, involving an expenditure of nearly 15 million dollars, in order to provide a channel with 35-ft. depth of water between Montreal and Quebec. Of the two minority reports, one recommends a combined scheme of dredging and training works entailing an outlay of rather more than 21 million dollars and the other an alternative scheme of dredging and training works at a cost of 14½ million dollars, but suggesting that the work be deferred for ten years, or "until the volume of overseas traffic in and out of Montreal has increased about 50 per cent."

The Board found the two most important causes of low water in Montreal harbour had been the reduced supply of water from the Lakes and the Ottawa River, and changes in the channel both at and below Montreal. They discarded ideas of dams with locks and weirs with the exception of the Ile Ste. Therese training project.

All members of the Board recommended new channels being dredged immediately at Three Rivers and Sorel. At Sorel the new down-bound channel would be dredged between Ile a la Pierre and Ile des Barques, without interference to the existing weirs. The view was expressed that the opening of the new channel would reduce the present betterment of water levels, but would greatly decrease navigation hazards and mitigate the danger of erosion. At Three Rivers ships pass close to the harbour front, disturbing ships moored to wharves. The engineers recommended a realignment of the channel to reduce the surges created by passing ships, adding to the useable depth for vessels moored to wharves. The new channel would be located opposite Three Rivers to the south of the mid-channel shoal.

L.N.E.R. Dock Improvements

Victoria Dock, Hull

The London & North Eastern Railway is at present carrying out considerable extensions and improvements to the facilities for the handling of timber at Victoria Dock, Hull. Three additional berths, suitably equipped for the expeditious handling of sawn timber from ship to bogie waggon and thence to the stacking areas, are being provided on the North East side of the dock, involving the reconstruction of an additional 300-ft. of quay, thus providing an extra 1,000-ft. of quayage for the discharge of timber direct to bogies. The quay will be about 40-ft. wide and is being equipped with the necessary railway lines, capstans and fairleads. The work is being carried out by the Company's Chief Engineer for Docks, and two of the new berths will be in commission by the end of June, while it is expected that the third will be completed by the end of September. The additional facilities will, it is anticipated, considerably relieve the congestion experienced at the height of the timber season during recent years at the Victoria Dock.

Grimsby Docks

Following the completion of the new Fish Dock in 1934, the L.N.E.R. is extending its facilities for the landing and dispatch of fish at their Grimsby Docks by the construction in No. 2 Fish Dock of new quays and fish markets. These, when completed, will provide an additional 860 lineal feet of quay as well as the improvement of about 350 lineal feet of quay at present in use for the landing of fish. An additional area of about 100,000 sq. ft. of up-to-date market accommodation will then be provided. The upper floors of the new markets will provide ninety offices for fish merchants, and about 23,000 sq. ft. of additional storage area for fish boxes and kits. A refreshment room, trawler stores and other facilities are also included in the scheme, as well as rail and road improvements.

The new markets will be constructed of reinforced concrete, and to obtain the additional floor area required, false quays are to be constructed in front of the existing quay walls, extending about 40-ft. into the dock. They also will be of reinforced concrete. About 27,000 cubic yards of concrete will be used and over 1,100 tons of steel.

Otago Harbour Board, New Zealand

Excerpts from Chairman's Annual Report for the Year ended September 30th, 1936

Receipts and Expenditure

It is very pleasing to be able to record a definite return to the days of prosperity. The tonnage handled has been most satisfactory, and several records have been established, while the receipts for the period amount to £178,131 9s. 1d., as compared with £164,376 11s. 5d. in the previous year. This increase has materially assisted the carrying out of our programme of harbour improvement, and after providing for interest on loans, contributions to sinking funds, and depreciation on plant, together with periodical loan repayments, the statement shows an excess of income over expenditure amounting to £6,214 14s. 10d.

Works Completed during the Current Year

The following works were completed:—Rail connection to Victoria Wharf (£5,073), Ravensbourne Wharf extension (£1,908), Mussel Bay retaining wall and main sewer (£5,978).

Works under Construction

These comprise:—

The Leith Canal, which is practically completed to the Anzac Bridge, but still requires about twelve months' work to cover the portion between Anzac Avenue and the Harbour.

Bowen Pier Widening for 700-ft. It is estimated that this will be finished by November or December and will provide much needed berthage at Port Chalmers.

Works Projected

These are as follows:—

Waterside Workers' Building, which should be ready for occupation about April next.

Customs Wharf Officers' Accommodation, which may be available about June or July next.

Birch Street Wharf Reconstruction.—This will be commenced early in 1937, and will probably take two years to complete.

George Street Pier Improvements.—It is proposed to commence the improvements on the south side of the George Street Pier immediately the export season closes in 1937, and to proceed in the following year (1938) with similar work on the north side of the Pier.

Cranage.—In addition to wharf improvements quotations are being obtained for two 5-ton cranes for George Street Pier, Port Chalmers.

Uniformity of Charges

During the year various anomalies which existed in respect to charges on goods and ships, and particularly the receiving and delivery charge, received serious consideration, and after exhaustive examination, it was decided that the receiving and delivery charge should be abolished, that a uniform berthage rate be established, that the overtime charge on petroleum products in bulk be reduced and that a new schedule of charges termed Harbour Improvement Rate be set up. The new system has been in operation for about two months of the present financial year, and much satisfaction has been expressed at the change particularly in respect to the abolition of the differential rates of berthage and the receiving and delivering charge.

Victoria Channel

Considerable attention has been given to both maintenance and development work in Victoria Channel, and with a comparatively small amount of further dredging the channel should show a depth of 22-ft. at low water. These improvements have resulted in a steadily increasing tonnage handled at Victoria Wharf, and when one considers the large vessels of 10,000 to 11,000 tons which now regularly berth at Dunedin, compared with the vessel which officially opened the Victoria Channel on December 30th, 1881, viz., the s.s. "Penguin" of 680 tons, one realises the very considerable improvements which have resulted from the Board's continuous dredging operations.

Lower Channel and Entrance

Dredging has been confined to maintenance work, and depths and widths have been adequately maintained, while even at the extreme end of the North Channel the encroachment of sand has been so slow that it has not given grounds for serious anxiety, but the time is rapidly approaching when definite steps must be taken to overcome this tendency. It is hoped, however, that the installation of a suction pump on the dredge will give satisfactory results, not only in the Lower Harbour, but especially in the North and South Channels at the Entrance.

Restoration of Wages and Salaries

The first 10 per cent. cut in salaries has been restored during the financial year, thus completing the restoration of the reductions made during the depression. In accordance with legislation passed during the year, the works and dredges were placed on a 40 hour week, the employees now receiving the same wages for the shorter working week as they did for a 5½ day week in 1931. This naturally has entailed a considerable increase in our wages bill.

The Report is signed by Mr. Jno. B. Waters, the Chairman of the Board.

The American Association of Port Authorities

We have received from New Orleans a reprint of an extremely interesting paper by Mr. J. Spencer Smith, President of the New Jersey State Board of Commerce and Navigation, and an ex-President of the American Association of Port Authorities, on the history of the Association from the time of its inception, 25 years ago, down to the present day. As far back as 1912, the late Mr. Calvin Tompkins, Commissioner of Docks of New York, whose name is honourably connected with the development of the Port of New York, Mr. G. W. Norris, director of the Philadelphia Department of Wharves, Docks and Ferries, and Mr. Hugh Bancroft, chairman of the Directors of the Port of Boston, issued an invitation to port authorities of the United States for a conference, the object of which, as stated in their circular, was "to exchange ideas relative to port organisation, to promote the exchange of information and the development of uniform methods of administration, and possibly to provide for some permanent organisation . . ." The Conference duly assembled at the Chamber of Commerce of New York, and, having approved of the project, elected a strong and representative Committee, a number of whom regrettably are no longer to be found in the ranks of the living. Mr. Smith speaks in warm terms of the services rendered by Mr. Calvin Tomkins, who "for two years was the power on our throne and then the power behind it—a great public servant, splendid character, a man who saw his world from the heights of sound and liberal philosophy, with an eye only for the public good." Associated with Mr. Tomkins was Mr. B. F. Cresson, who subsequently became first Engineer-in-Chief of the Port of New York Authority, Mr. Chas. Staniford, chief engineer of the New York docks, and Mr. Tiley S. McChesney of the Port of New Orleans, who has been a valuable supporter of, and an untiring worker for the Association right down to the present day.

At the outset, the infant Association had its difficulties which were overcome by determination and perseverance. Several annual meetings or "conventions" were held, and in 1914, the title of National Association was changed to the "American" Association of Port Authorities, in order to obtain the co-operation of Canadian authorities, who responded at once, Montreal, Hamilton and Toronto joining the same year. The fifth convention in 1916, was held in Montreal. In 1919, following the War and consequent on a certain degree of lassitude and indifference the Association was not far from dissolution. At the Galveston meeting in that year only eight member ports were represented. Energetic measures, however, were adopted, and Mr. Secretary Fennell came to the front. He started the "Monthly Bulletin," which subsequently developed into "World Ports," with a wide circulation. The corner was turned. In a year the membership was almost doubled. From 1920, the Association embarked on a career of eager and active progress, constituting committees on a variety of matters with useful and practical results. Among those connected with the Association at the time was Admiral F. J. Chambers, as a representative of the Navy.

One amusing incident in the record of the conventions deserves notice. The 1928 Convention was held at Houston and Galveston. "But that meeting in 1928," writes Mr. Spencer Smith, "was in prohibition days and on one point perfect confidence never was placed in anybody. Our bountiful neighbours of the North knew this, and came down from Canada with elephant-edition thermos bottles. Then they gathered the Convention the best they could into their suite before any other entertainment offered. The finest laurels of the conference undoubtedly would have rested on their brows, but, somewhere in the interval between the lobby and the room number, the quality of their baggage had been found out, and when it came to fill the glasses, tinkling with little cubes of ice, nothing but water was there to pour!"

It would take too long to follow the Association through all the details of its history, but the foregoing brief summary of its activities will serve to show how capable and vigorous a body it is, and to explain its position to-day as the recognised living exponent of American practice on port affairs.

Facilities for Coastal Trade at Ports in England, Wales and Scotland

Third Section of the Report by Messrs. WILTON & BELL, MM.Inst.C.E.

(continued from page 233)

Depths and Accommodation at Scottish Ports.

(19) Dealing next with the Scottish ports on somewhat similar lines to those adopted for the English and Welsh ports, we wish to point out that as trade in Scotland is confined to more circumscribed areas than in England and Wales, it was not considered necessary to visit some of the smaller ports in the extreme north, nor in the various islands which lie off the Scottish Coast, where normal coasting trade could only be very small indeed.

Scottish Ports not up to 14-ft. Draught on Neap Tides

(20) Of the Scottish ports which we inspected, as given in Lists "B" and "D," numbering twenty-eight, we follow a similar procedure to that adopted in § 6, and placed in List "C" for convenience of reference the following ports which are not up to the standard of berthing a 14-ft. draught vessel at H.W.O.N.T. They are:—

LIST "C."

Annan	Stranraer (except the Railway Quay)
Dumfries	Perth
Kirkcudbright	

Actually, all these, with the exception of Stranraer, would also come below the 10-ft. neap tide standard referred to in § 8.

(21) Dealing with these seriatim, as we did with the English and Welsh ports, we have the following observations to make:

(a) **Annan.**—Annan may be described as only a spring-tide port and difficult of access up a winding river. We were informed that a 12-ft. draught ship can come up, but the river is narrow, and a strong easterly wind will cut the tide heavily. The limit of length of ship is about 150-ft., and there is difficulty in turning.

(b) **Dumfries.**—There are two quays at Dumfries. Glencaple near the mouth of the River Nith and Kingholme Quay, about 1½ miles from the centre of the town.

We were informed that there was only 10-ft. alongside Kingholme Quay at H.W. of an ordinary spring tide. In addition, the river is unlighted and narrow, so that the port must be regarded as a daylight port only.

Glencaple, lower down the river, is stated to be very little used, on account of the long haulage from Dumfries.

(c) **Kirkcudbright.**—Kirkcudbright consists of one quay at the Town of Kirkcudbright, which is 14 miles from the mouth of the River Dee.

The Sailing Directions give 14-ft. at H.W.O.S.T. and 8-ft. at H.W.O.N.T. as the draughts which can come up the river, but we were informed that the depth in the dredged berth alongside the quay is considerably more.

Silting causes trouble in the river, and as it is unlighted Kirkcudbright can only be regarded as a daylight port.

It would not be difficult to bring this port up to a 10-ft. standard at H.W.O.N.T., but it might be necessary to dredge to keep it up to this standard.

(d) **Stranraer.**—Stranraer, at the south end of Lock Ryan, is the starting point of the London, Midland and Scottish Railway steamers to Larne. The Railway Company maintains the pier, which is leased to them, at a depth of 15-ft. below L.W.O.S.T.

The remainder of the harbour has been allowed to silt up, and is not now up to the 10-ft. neap standard.

(e) **Perth.**—Perth consists of an upper and lower harbour, of which the upper harbour (the one most used) is in a tidal creek, and the maximum draught of ships that can use the port we were given as from 12-ft. to 13-ft. on a spring tide.

The harbour is in a narrow tidal creek, a considerable distance above Dundee, and there is only three hours' flood.

(22) To bring Annan, Dumfries and Perth up to a 14-ft. spring and 10-ft. neap draught standard would involve considerable works being undertaken.

Of the remainder, Kirkcudbright and Stranraer would require dredging to bring up to the 10-ft. neap standard, and after that, intermittent attention to keep the silting in check.

Of these, Stranraer with more extensive outlay would be brought up to a 14-ft. neap standard, but this would involve repairs to the quays, which are not at present in good condition. In this connection, it may be noted that the town of Stranraer, as owners of the harbour, has the right to the casual use of the railway pier, when this is vacant, where there is ample depth for all modern coasters.

(23) It will be seen from this List "C" that of the ports visited only a small number are not up to the 14-ft. standard at H.W.N.T. Some of the smaller fishing ports, on the west coast, and the Moray Firth ports, do not come up to this standard, but as they only deal with a very small amount of coastal trade, and that in connection with their own industry, they have not been considered in this report.

Scottish Ports up to 14-ft. Draught on All Tides

(24) Of a total of twenty-eight ports in Lists "B" and "D" the following twenty-three ports are up to the 14-ft. draught standard at H.W.O.N.T., though all are not able to take a 14-ft. draught vessel at any state of the tide.

Ayr	Fraserburgh
Troon	Peterhead
Irvine	Aberdeen
Ardrossan	Montrose
Greenock	Dundee
Port Glasgow	Methil
Glasgow	Kirkcaldy
Fort William	Burntisland
Mallaig	Alloa
Kyle of Lochalsh	Grangemouth
Stornoway	Leith
Inverness	

(25) As with the English and Welsh ports dealt with in § 15 where ports are not up to the standard of taking a 14-ft. draught vessel at any state of the tide, in some instances there might be justification for the expenditure of money to bring them up to that standard. Conclusions as to this may be reached from the information given in the following notes:—

(a) **Ayr.**—This port is entered between two arms of a breakwater, which are 320-ft. apart. There is a depth of 15-ft. over the bar at L.W.O.S.T., which depth is held over most of the harbour, so that coasters enter and leave at any state of the tide.

Coasting traffic, other than the specialised coal traffic, is dealt with in Ayr Harbour, which is the lower part of the River Ayr, and is tidal.

The main berth for general cargo is on the south side of the harbour, where there is a depth alongside the quay of 16-ft. at L.W.O.S.T.

The North Quay, at the east end of which is the deep-water berth, has a depth alongside ranging from 16-ft. to 21-ft. L.W.O.S.T. There are apt to be freshets of considerable volume, after heavy rain in the mountains.

The Wet Dock, which is entered through a passage 60-ft. wide, with a single pair of gates, which restricts the period of entry to near high water, is mainly devoted to the coal trade, and the worst depth in the dock is given as 16-ft.

(b) **Troon.**—Troon, like Ayr, has been developed mainly for the coal and ore trade, and is of the same general type, consisting of an Outer Tidal Harbour and an Inner Wet Dock.

It is entered from the sea between pierheads 260-ft. apart.

The harbour can take ships up to a maximum draught of 23-ft. at L.W.O.S.T.

The main deep-water quay, known as the Pierhead Berth, is along the West Pierhead, and has a length of 600-ft. with a depth alongside of 20-ft. at L.W.O.S.T.

The South-West Quay, including the tongue between the West Dock and the Outer Harbour, provides two berths, each about 800-ft. long and has a depth of 15-ft. at L.W.O.S.T. alongside.

The South-east or Cross Breakwater and the East Breakwater have a depth alongside of 11-ft. at L.W.O.S.T.

The Wet Dock is entered by a passage 45-ft. wide, with a single pair of gates, has a general depth of 17-ft., and, as at Ayr, is used for the coal trade, entry being restricted to the period of high water.

(c) **Irvine.**—Irvine is situated on the left bank of the River Irvine, and is approached from the sea by a straight channel leading through a dredged cut in the bar, about 1,000-ft. out.

There are no outlying dangers, but the harbour is open to the west through nearly 180°, and in a gale from this quarter access is always difficult.

The width of the approach channel is 300-ft., and there is 15-ft. of water at L.W.O.S.T. on the bar.

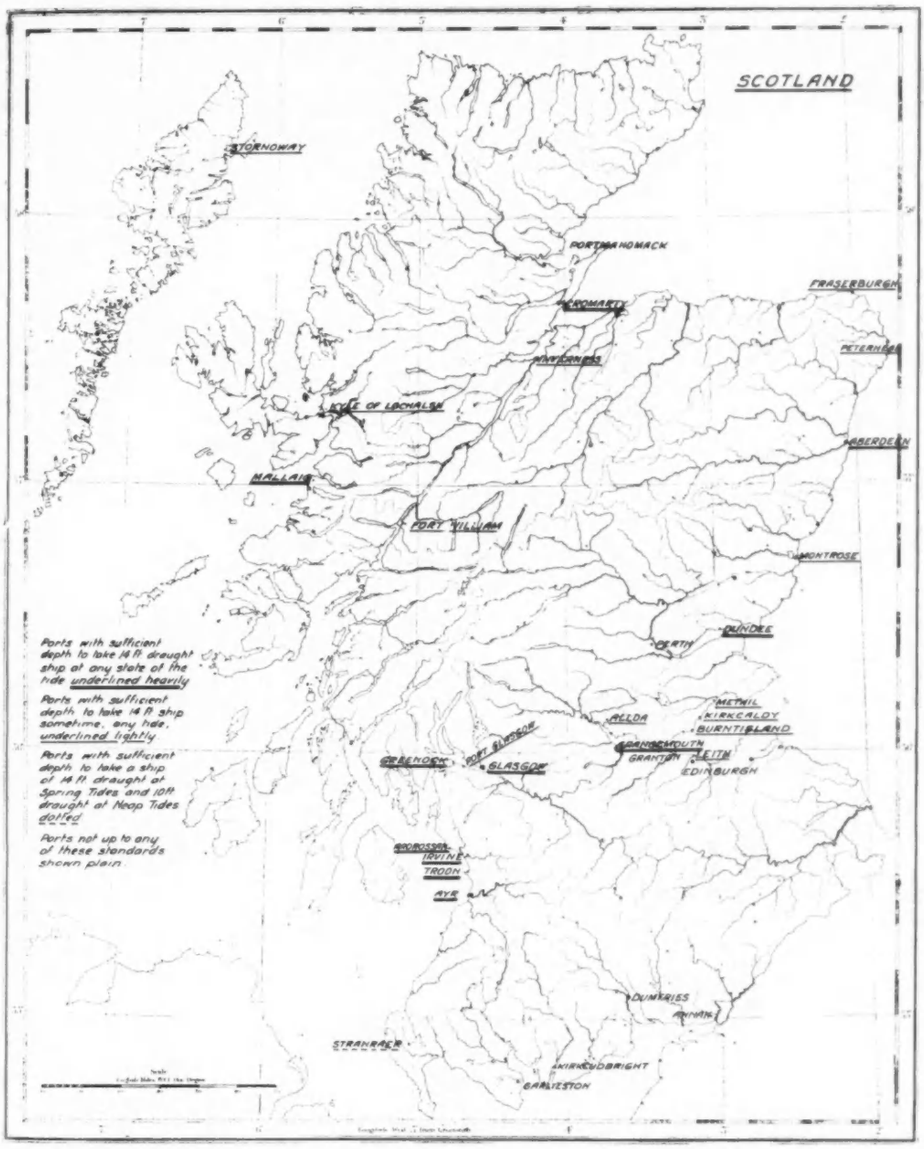
In the harbour there is 1,900-ft. of quay, all in good condition, and with nowhere less than 13-ft. 6-in. of water at L.W.O.S.T. and 3-ft. of soft mud below that, most of the berths being able to take a 14-ft. draught vessel at L.W.O.S.T.

Facilities for Coastal Trade at British Ports—continued

(d) **Ardrossan.**—Ardrossan is the largest of the four ports, which are situated on the Ayrshire coast. It will take ships up to 14,000 tons at H.W.O.S.T.

The harbour is mainly tidal, and the depths alongside are as follows:—Eglington Tidal Basin, H.W.O.S.T. 28-ft., L.W.O.S.T. 18-ft.; the Belfast steamers sail from this berth. Eglington Dock is maintained at a depth of from 25-ft. to 28-ft., and is entered through a passage 56-ft. wide, with a single pair of gates which restricts entry to a period near H.W.

The old tidal basin has a depth alongside of 19-ft. at H.W.O.S.T. and 9-ft. at L.W.O.S.T.



The harbour, with the exception of the Belfast mail-boat traffic, has been mainly developed for the export of coal, and appears adequately equipped for such trade. The major portion of it can be used by 14-ft. draught ships at any state of the tide.

(e) **Greenock.**—Greenock lies on the south bank of the Clyde, about 25 miles down river from Glasgow, and is in the centre of the shipbuilding industry, so that it normally does a large trade in the commodities required for that industry.

The coastal trade is mainly centred along the Custom House Quay, where there are a number of tidal berths with depths alongside of about 16-ft. at L.W.O.S.T., which can be used by the coastal trade at all states of the tide. As the prevailing wind is from the south-west, ships lie easily at this quay, and can generally get away without trouble.

The coastal trade also has the casual use of the East India Harbour, which is tidal, and has a depth of 10-ft. at L.W.O.S.T., but repairs are being carried out with the intention of deepening this dock.

The Victoria Dock, with 14-ft. at L.W.O.S.T., and the James Watt Dock, where the depth is 29-ft., would normally only be used by coasters for coal traffic or for any heavy cargo with which their own gear would be inadequate to deal, as it is mainly intended for ocean-going vessels.

The James Watt Dock is entered through the basin by means of a single gate entrance, about 80-ft. wide. Generally speaking, Greenock, with the exception of the James Watt Basin, can be used by coasting vessels at any state of the tide, which, as it is only a calling port, is of very great advantage.

(f) **Port Glasgow.**—This port, two miles above Greenock, appears to have lost its trade to Glasgow and Greenock. There is a depth of 20-ft. at H.W.O.S.T. in the entrance to the basin, and a depth of 10-ft. at low water alongside the wharves.

(g) **Glasgow.**—Glasgow has a very large coastal trade, the berths are all very similar, and are excellently grouped together both banks of the Clyde in the centre of the City.

The berths allocated to the coastal trade extend from George V. Bridge on both sides of the river down to the Ferry by Finnieston Quay.

There is, in addition, the Custom House Quay above George V. Bridge, but vessels using this quay, which is mostly used for limestone, asphalt, etc., must lower masts and funnels to go under the bridge, and the largest ships that can get there are of 300 to 350 tons drawing 10-ft. of water.

The remainder of the coastal trade berths have depths of from 18-ft. to 24-ft. alongside at L.W.O.S.T., so can deal with the largest vessels in that trade at any state of the tide.

From an operating point of view, all the coastal trade of Glasgow is centralised in this very small area, which is right in the centre of the City and surrounded by wide roads. We were informed that the coastal trade prefers this position to any other, and that they do not wish to move from it.

(h) **Fort William.**—Fort William, at the western end of the Caledonian Canal, has an old quay alongside the railway, at which there is about 8-ft. depth of water.

In addition, Messrs. MacBrayne have a modern reinforced concrete pier with a crane, which they use in connection with their island traffic, and at which the depth is up to the 14-ft. draught standard at most states of the tide. This latter pier seems likely to be quite capable of dealing with all the probable traffic of the neighbourhood.

(j) **Mallaig.**—Most of the accommodation here is at the London and North-Eastern Railway Pier, on the western side of the bay. There is from 10-ft. to 16-ft. of water at L.W. alongside.

There are two berths at this pier, but we were informed that one of them is uneasy in rough weather.

There is a small amount of trade, mainly with the western islands, and it does not appear likely that it will increase to any great extent. On the mainland the countryside is mountainous and poor, and the railway connection consists of a single track railway line. Passengers going from the boats to the trains have to walk over lines of sidings on the railway.

(k) **Kyle of Lochalsh.**—Kyle of Lochalsh is mainly used by Messrs. MacBrayne's island passenger and mail traffic. The depths alongside the piers are about 24-ft. H.W.O.S.T. The depths at H.W.O.N.T. are about 14-ft. less. At L.W.O.S.T. the depths at the pier would be about 10-ft. to 12-ft. The railway station is on the pier.

(l) **Stornoway.**—This is the main distributing port for the western islands, and during the season is a very big base for the fishing fleet.

The harbour is absolutely land-locked, and we were informed that there is never any difficulty in entering during rough weather, and once inside it is, of course, calm. Over the main

Facilities for Coastal Trade at British Ports—continued

portion of the harbour there is very ample depth, and inside the harbour and in the approaches to Cromwell Quay, it is proposed to dredge to 8-ft. below L.W.O.S.T., as the depth at present is less than this.

Cromwell Quay has been recently reconstructed, and is now a good broad quay, which will be of great use when the approaches, etc., have been dredged away.

Quay No. 1, the mail-boat quay, is an old greenheart quay with a very bad and unnecessary elbow in front of the quay. We have been informed, since our visit, that it has been decided to rebuild this quay, altering its alignment to secure a straight run in, and dredging alongside to give a depth of 18-ft. at all states of the tide.

(m) **Inverness.**—Inverness occupies a sheltered position at the south of the River Ness in the Beauly Firth, and appears to have great advantages, being at the eastern end of the Caledonian Canal, and from its geographical position should serve a great deal of the north of Scotland.

The main berths are along the Shore Street Quay, extending for about 1,200-ft. along the south side of the River Ness.

The three eastern berths have a depth alongside of about 4-ft. at L.W.O.S.T. and 14-ft. to 16-ft. at H.W.O.N.T.

Further west, the quay has lately been reconstructed, and the river has been dredged, resulting in a depth of from 18-ft. to 22-ft. alongside at H.W.O.S.T., with neaps about 3-ft. lower.

This quay, if trade warranted, could easily be extended a further 300-ft. towards the mouth of the river, and if properly laid out should improve the approaches.

Farther down the river, on the left bank, there is an old quay, the Thornbush Quay, which is in a good position, and has adequate depths, but would require to be repaired before using.

The approach channel to Inverness could be improved, as there is a spit running out almost opposite Thornbush Quay, which makes an awkward bend.

The Commissioners would like to dredge a portion of this spit away but are prevented by lack of funds, which is unfortunate as it would improve the approaches considerably. Further dredging could, with advantage to the harbour, be carried out higher up the river by the Shore Street Quay and adjacent to the railway bridge, as this would improve the depth alongside the quays, and should, in addition, help to remove the spit opposite Thornbush Quay. We were informed that the Railway Company were averse to this, owing to the possibility of the increased scour affecting the foundations of their bridge piers.

(n) **Fraserburgh.**—Fraserburgh is a typical fishery harbour that has grown piecemeal. We understand that during an onshore gale there is a considerable surge, as the sea has an almost straight run in. We were informed that the depths could be taken as from 8-ft. to 12-ft. at L.W.O.S.T., which would give a depth of from 16-ft. to 20-ft. at H.W.O.N.T.

It may be taken that the coastal trade is mainly in connection with the fishing industry, but as there is a large fleet based on this port they require a number of sea-borne stores, and so the port was visited, as was Peterhead.

There are no coastal trade berths specially allocated for that purpose, but the ships are accommodated at any empty berth near the town.

The harbour suffers from having quay walls with an excessive batter; those walls, which are in the worst state of repair, were being refaced, and in carrying out this repair the excessive batter was being eliminated.

Although Fraserburgh looks a difficult port to make in an onshore gale, we were informed by the harbour master that he did not consider it to be a dangerous port, except for the smaller craft.

(o) **Peterhead.**—Peterhead is another fishery harbour, but has a certain amount of coastal trade in connection with the fishing industry. It consists essentially of four harbours, viz.: the Harbour of Refuge, Port Henry Basin, North Harbour and South Harbour.

The Harbour of Refuge, which is not yet finished, is being built by the Government mainly, as its name implies, for a refuge to shipping during gales. Port Henry Basin, which has been repaired and deepened to 12-ft. below L.W.O.S.T., is used by the fishing industry. North Harbour is used mainly by the fishing industry, but is used also for ships bringing in salt, etc., and exporting fish. South Harbour is where the larger ships berth, as the junction canal which forms the passage between it and the North Harbour Inner Basin is only 33-ft. 9-in. wide.

There are two entrances into the harbour from the south by way of the Harbour of Refuge, and from the north by the north entrance; this latter entrance is only used in fine weather, as there is a bad backwash during an onshore gale. There is also a backwash during a south-east gale at the south entrance, but there is more sea-room in the Harbour of Refuge.

Coal and other commodities are brought into the Bridge Street Wharf in this harbour, and unloaded directly into lorries.

The South Harbour will allow a draught of over 16-ft. at H.W.O.N.T., and as the Harbour of Refuge has comparatively deep water at all stages of the tide, vessels can, if necessary, wait there in safety until there is sufficient water in the Inner Harbour.

(p) **Aberdeen.**—Aberdeen, the most northerly of the larger ports of Scotland, is divided into the tidal portions, which include the Tidal Harbour, Albert Basin and the lower part of the River Dee and the Wet Dock portion comprised in the Victoria and Upper Docks.

The harbour faces N.E. by E., and is entered between two breakwaters with an effective width of 585-ft., the depth of the navigation channel being 32-ft. deep at H.W.O.S.T., which will give a depth of about 20-ft. at L.W.O.S.T.

Coasting vessels are berthed mainly in the Upper Dock and the Victoria Dock, which are entered from the tidal harbour by a single gate entrance 70-ft. wide, and with 26-ft. on the cill at H.W.O.S.T., but as the cill is haunched the effective depths are less. This is the only entrance to the Wet Dock System, as the 250-ft. lock entrance is not now used, and therefore the period of entry to the system is restricted.

The Upper Dock, with a depth generally of over 20-ft., is entered from the Victoria Dock through a passage 67-ft. wide with no cill.

In the tidal harbour, to which entry for ships of 14-ft. draught is unrestricted, there are quays with adequate depth alongside, both in the River Dee and the Albert Basin. The latter is a fish basin, but there are oiling facilities on the quay for oil-burning ships.

One rather serious objection to the harbour, which it shares in common with others on this rock-bound coast, is that it is exposed with a clear run in from the north-east, so that in a gale a big sea runs in, and there is a considerable amount of surge in the tidal portions. The Harbour Authorities have constructed wave traps in order to lessen the run.

(q) **Montrose.**—Montrose used to do a considerable trade, especially in the export of potatoes, but latterly this has dropped considerably.

There is a Wet Dock at the town with 19-ft. on the cill at H.W.O.S.T. and about 15-ft. to 16-ft. at H.W.O.N.T., but there is only a single pair of gates, so that the times of entrance into the dock are restricted. In addition, the channel leading to it is liable to silt.

(r) **Dundee.**—At this port the regular coastal services are berthed in the Victoria Dock, to which access is obtained through an entrance 60-ft. wide with 21-ft. 7-in. on the cill at H.W.O.S.T. and 18-ft. 7-in. at H.W.O.N.T.

The coasting trade also has the use of the Western Wharf, which is a tidal wharf of timber construction, with a depth alongside of 19-ft. at L.W.O.S.T. and 34-ft. at H.W.O.S.T.

The port, being mainly developed for the seasonal jute import trade, the sheds are mostly exceptionally wide, with good trucking surfaces and very light.

(s) **Methil.**—Methil was developed entirely for the purpose of exporting coal from the Fifeshire coalfields, and for that trade is an exceptionally fine and up-to-date port.

Like all the ports on the north-east of Scotland, it is in an exposed position and somewhat difficult for small ships to make in an onshore gale, but there should be good prospects for coastal trade, as there is a wealthy district inland with good railway facilities.

The coastal trade is accommodated in Docks Nos. 1 and 2, which are the older docks of the port, and though built for the coal trade, are not naturally so up to date as Dock No. 3, which was opened just before the war.

Nos. 1 and 2 Docks are served by an entrance with a single pair of gates, which lead direct into No. 2 Dock, the width being 50-ft. with vertical walls, and depth on the cill 26-ft. at H.W.O.S.T. and 21-ft. at H.W.O.N.T. As a southerly gale tends to drive waves straight in, wave traps and storm gates are provided. Owing to there being no lock, times of entrance are restricted to a period near H.W.

Dock No. 1 is entered from No. 2 Dock by a passage 50-ft. wide, and has a depth of 22-ft. at springs and 17-ft. at neaps. As the walls of the passage are vertical, full advantage may be taken of its width.

(t) **Kirkcaldy.**—Kirkcaldy consists of an outer or tidal harbour and an inner non-tidal harbour. The entrance to the outer harbour is between pierheads, about 150-ft. apart, and the harbour is protected from the east by a breakwater running practically north and south.

The breakwater is subjected to very heavy seas, especially from the east through to the south, and with a gale from these quarters the entrance to the dock would be difficult, but the Harbour Master informed us that they did not often have to close the harbour.

The Inner Dock, where the working berths are situated, is entered through a passage 50-ft. wide, with 21-ft. on the cill at H.W.O.S.T. and 15-ft. 6-in. at neaps, the sides being vertical.

Facilities for Coastal Trade at British Ports—continued

so that it will take all coasters, though as there is only a single pair of gates, entry is restricted to near the time of high water.

The dock itself is a peculiar shape, and does not appear easy for working, as the only straight quay of any length is on the north side of the harbour and used by Coast Lines, Ltd.

There is road and rail access to every quay, and the surfaces are fair.

(u) **Burntisland.**—Burntisland is entered from the estuary of the River Forth, between two breakwaters.

The harbour is tidal, the width between the two breakwater pierheads being 250-ft. The depths in the Outer Harbour are 15-ft. at L.W.O.S.T. and 30-ft. at High Water Springs.

From this Outer Harbour the East Dock is entered through a single gate entrance 60-ft. wide, with 28-ft. 6-in. on the cill at H.W.O.S.T.

This dock is equipped for the deep-sea export coal trade, and so does not enter into the scope of this report, except to notice that the entrance is equipped with storm gates, which points to the Outer Harbour being somewhat rough in onshore gales.

There is a passage 125-ft. wide between the Outer Harbour and the Inner Harbour, from which an entrance 39-ft. 6-in. wide with 22-ft. 6-in. on the cill at H.W.O.S.T. and 16-ft. 6-in. at H.W.O.N.T., leads into the West Dock. General coastal trade is accommodated in this dock, but as there is only a single pair of gates, entry is restricted to near the time of H.W.

Its position not being in a direct line from the Outer Harbour and being protected from direct seas by the tongue between the two harbours, the entrance to this dock must be comparatively quiet, as in addition, there is a large area of the inner portion of the Inner Harbour in which waves can expend themselves.

As the West Quay of the Inner Dock, which is the only quay on which there is not a coaling crane, there is ample depth for coasters, and there is road and rail access.

We were informed that there was very little general coastal trade to this dock, and apparently the West Quay of the West Dock is not used to its full advantage.

It has road and good rail connections, and with more trade it might pay to instal electric level luffing cranes for cargo handling.

(v) **Alloa.**—This port, on the north bank of the River Forth, is a small port with riverside quays and a wet dock with a single pair of gates.

There are not many difficulties, the main ones being the strength of the tide and the position of sand banks, though neither ought to offer much impediment to a modern coasting vessel.

Ships can come up the river by day and night, and vessels of 10-ft. to 12-ft. draught can approach the quay on the river bank at all states of the tide.

The Wet Dock entrance is 45-ft. wide, with a single gate entrance, and there is 10½-ft. on the cill at H.W.O.S.T. and 15-ft. at neaps. The sides being vertical, full advantage can be taken of the width.

There is road and rail access, but the port generally is out of date, especially with regard to equipment and general lack of sheds. Whether it would pay for modernisation is doubtful, but this could be done at a comparatively cheap rate.

(w) **Grangemouth.**—The Grangemouth Dock system, the whole of which is impounded, opens directly into the River Forth, from which ships can be locked in during a period of four hours before H.W. to three hours after.

The entrance lock is 626-ft. by 80-ft., and has 30-ft. on the cill at H.W.O.S.T. and 4-ft. less at neaps, the spring range being 18-ft.

The coastal trade is accommodated in the older part of the system, i.e., the Carron Dock and the Old Dock, the former of which is entered from the west channel, through the West Cut, which is 60-ft. wide. The depth in this dock varies from 20-ft. to 23-ft., so is ample for the coasting trade.

Out of the Carron Dock open the Old Dock, with a depth of about 19-ft., and the Junction Basin with a depth of about 17-ft.

Generally speaking, the coastal trade is dealt with in this area, the remainder of the somewhat extensive system of docks at Grangemouth being developed for the deep-sea trade.

There are large oil depots near the entrance lock to the system, and most of the berths are very well equipped with railway connections, and coaling appliances, generally speaking, are good, but the road facilities are not good.

A large amount of the system is channel with pitched slopes, and therefore the quayage can be increased to a marked extent when conditions warrant it.

(x) **Leith.**—This port, on the south bank of the River Forth, consists of the lower portion of the River Leith, which is tidal, and the various wet docks leading from it.

The entrance is between pierheads, about 230-ft. apart, through a dredged channel with a depth of 17-ft. at L.W.O.S.T.

The general coastal trade is handled at tidal quays in the Outer Harbour, of which the most up-to-date is that used by the General Steam Navigation Company, where the cargo-handling facilities are excellent.

This berth, and many of the other Outer Harbour berths, can be used by 14-ft. draught coasting ships at all states of the tide.

There are also berths in the Albert and Edinburgh Docks, which are entered from the Albert Dock Basin, through a lock 60-ft. wide, with 25-ft. at H.W.O.S.T. and 22-ft. 6-in. H.W.O.N.T. on the cill, the dimensions of the passage into the Edinburgh Dock being similar. It will be seen that the depth in these docks is ample for the coasting trade.

On the other bank of the river are the East and West Old Docks, which are not very much used at present, except for laying up ships. These docks have a depth of from 12-ft. to 15-ft., and the entrance to them is 35-ft. wide, with a depth on the cill of 17-ft. at H.W.O.S.T. and 14-ft. 6-in. at H.W.O.N.T.

These docks and the Victoria Dock, which is also entered from the Outer Harbour, through a single gate entrance 60-ft. wide, with a depth on the cill of 23-ft. at H.W.O.S.T., are very conveniently placed with regard to the town, with excellent road and rail connections, and if modernised should be very suitable for the coastal trade, except for the restriction as to times of access to the system.

(26) Of the foregoing ports, it will be seen that Ayr, Troon, Irvine, Ardrossan, Greenock and Glasgow on the West Coast, and Aberdeen, Dundee, Grangemouth and Leith on the East Coast, are all up to the 14-ft. standard at all states of the tide.

(27) All these ports are modern deep-sea ports, and as coastal trade is only incidental it is, as is natural, dealt with in the older parts of the system, but it does not follow that in every instance this is a disadvantage, as in many ports the older portion is most centrally placed with regard to the City, but it does mean that very often the cargo-handling facilities, the transit sheds and carting surfaces, are out of date, and do not give the best service in handling the cargoes.

(28) Generally speaking, with the exception of Glasgow, Aberdeen and Leith, which serve areas of large population, the ports have been developed for the import or export trade of certain commodities, such as the ports of Ayr, Troon, Irvine, Ardrossan and Grangemouth, which normally deal with the export of coal and the import of large quantities of ore for the use of the nearby steel-works, and to ports engaged in this latter trade must be added Greenock, which is equipped to deal with plates and sections for the use of the shipbuilding yards on the Clyde.

(29) Dundee's main trade is the seasonal overseas one of jute, and for this purpose it is exceptionally well equipped, but so far as we were able to gather, with the exception of the few months during which the jute trade is at its height, the quays and sheds are not worked to their full advantage.

(30) Certain berths at Mallaig, Fort William and Stornoway, are, or will be at an early date, up to the 14-ft. standard at all states of the tide, but with the exception of Stornoway, which has a certain amount of trade in connection with the fishing industry, they deal mainly in trade to the western islands, and neither that trade nor the possibility of increased trade on the mainland, appear to warrant any further expenditure on improving the facilities, except as regards the accommodation for passenger traffic at Mallaig, which is decidedly poor, passengers, as stated before, having to walk over lines of sidings between the passenger station and the boat quay at which the mail boat berths.

(31) Inverness, despite the natural and geographical advantages it possesses in being land-locked and in a position to serve the north of Scotland, only does a small trade to the immediate neighbourhood, and the majority of the carrying trade to the neighbourhood is in the hands of the railways; but it must be remembered that the population of the north of Scotland is very small, and even if the majority of the staple products of the neighbourhood came in by sea, it would not mean a very large trade for Inverness.

(32) Methil, Burntisland and Kirkcaldy all suffer from being in an exposed position, and the coasting berths are in wet docks entered through single pairs of gates. Thus, although the depth in the entrance channel may be more than sufficient, it is obvious that if there is only a single pair of gates leading to the wet dock, entry thereto must be restricted to a few hours at high water. It is, however, very doubtful whether the financial expenditure on the provision of a second pair of gates to provide a lock entrance would be justified at these ports, as the cost would almost inevitably be high.

Details of some Scottish Ports Not Inspected

(33) In addition to the above ports with which we have dealt in the preceding paragraphs, we received details by letter from the Harbour Authorities of the following ports:—

Garlieston	Portinghomac
Cromarty	Granton

We append extracts from these as being of interest:—

(a) **Garlieston.**—Garlieston, in Wigtownshire, has quayage of about 420-ft., with depth of water alongside of from 18-ft. to

Facilities for Coastal Trade at British Ports—continued

20-ft. at H.W.O.S.T. and 12-ft. to 14-ft. at H.W.O.N.T., so that it is not up to the standard capable of taking 14-ft. draught at neap tides.

Being in an agricultural district, it deals mainly with manure, feeding stuffs and coal.

(b) **Cromarty.**—Cromarty has a depth alongside the Outer Pier of 25-ft. at H.W.O.S.T. with neap tides about 2-ft. 6-in. lower. We are informed that there is a depth alongside the pier of 18-ft. at low water. Owing to depression, there has been very little trade to this port of late years.

(c) **Portmahomac.**—Portmahomac has silted up to such an extent that the maximum draughts are now from 10-ft. 6-in. to 11-ft. 6-in. at H.W.O.S.T. and about 2-ft. lower at neaps.

The harbour walls are stated to be in good condition, and there is said to be a possibility of trade in connection with the potato and farming industry, but it is doubtful whether, owing to finance, this harbour can be brought into a working condition.

(d) **Granton.**—Granton is an entirely artificial harbour on the Firth of Forth, the distance apart of the breakwater pierheads being 300-ft.

There is a depth alongside the quays varying from 12-ft. to 20-ft. at L.W.O.S.T., and ships of 21-ft. draught can always be kept afloat. Ships of 13-ft. draught can enter at all states of the tide, so that this port is up to the 14-ft. standard, except at the extreme low water of the bigger springs.

Impending Developments at the Port of Åbo, Finland

At a recent meeting of the Åbo Port Authority plans were approved for the proposed reconstruction and enlargement of the harbour. The programme covers the years 1938 to 1944.

In accordance with the new plan, the channel to the port will be dredged to a depth of 27-ft. at normal water level. At the same time, and as a preliminary measure, a part of the quay alongside the channel will be rebuilt in durable material to allow of a depth of 27-ft. alongside, and at a later date, it will be rebuilt in concrete. Work on a new quay in the northern part of the Slotts fiord will be commenced as soon as circumstances permit. This quay is designed to be 260 metres (845-ft.) in length, and is to be constructed in reinforced concrete and granite, and to be supported by timber piles. It will be provided with three rail tracks, four sheds covering an area of 3,000 square metres, and four cranes. The depth alongside will be dredged to 27-ft. at normal water level over a channel 60 metres (195-ft.) in width.

The railway line will be connected with the line from the oil harbour near the Saukonoja bridge, which will necessitate the construction of a shunting station in the immediate vicinity of the quay. The surface formation for the rail track will not be commenced until after 1938.

An area of 22 hectares (about 53 acres) will be reclaimed near the Pansio district by the spoil from the dredging operations. This area is much needed for the erection of industrial buildings. The programme further includes repairs to a total of 900 metres (2,925-ft.) of quay and sea-wall along the Aura River.

The cost of the entire programme is estimated at 47,635,000 Fmks. (£247,000), of which about 20,000,000 Fmks. will be used for the building of the new quay (rail-tracks and dredging included), 2,200,000 Fmks. for the dredging of the main channel, 15,500,000 Fmks. for reconstructing the quay alongside the channel, 6,900,000 Fmks. for rebuilding the quayside along the Aura River, 2,400,000 Fmks. for reclamation work in the Pansio district, and about 1,000,000 Fmks. for the provision of warehouse accommodation, etc.

Whitehaven Harbour Improvements.

A Bill is at present before Parliament for the purpose of adjusting the Whitehaven Harbour Company's finances so as to give effect to the recommendation by the Commissioner of Special Areas that a loan be granted for improvements at Whitehaven Harbour, estimated to cost £25,000.

Humber Ferry Improvement.

A new landing pontoon at the Victoria Pier, Hull, for the improvement of the ferry between the port and New Holland has recently been brought into service. The new pontoon has long been needed in view of the heavy traffic between Hull and North Lincolnshire, particularly regarding motor vehicles. Constructed at a cost of approximately £38,000, the pontoon is 150-ft. long and 50-ft. wide. It has been placed at the western end of Victoria Pier, with a steel latticed approach bridge of 180-ft. span, affording a carriageway and footpaths for pedestrians.

Dock Improvements at Liverpool.

The Mersey Docks and Harbour Board, on June 17th, confirmed the recommendation of the Works Committee to carry out a scheme, estimated to cost £732,000, in providing improved facilities at the West Waterloo Dock, where it is proposed to construct a new river entrance lock for the docking and undocking of vessels engaged in coastwise trade. This scheme has already been outlined in our issue of April, 1937.

The scheme comprises a lock entrance 450-ft. long by 65-ft. wide, which will enable ships drawing up to about 17-ft. of water to enter and leave the docks at practically any state of the tide instead of as at present, from one-and-a-half hours before high water to half-an-hour after high water.

Correspondence

(The Editor will be pleased to receive communications from readers on matters of interest).

To the Editor of the "Dock and Harbour Authority."

22nd June, 1937.

Dear Sir,

On reading Messrs. Wilton and Bell's Report, recently published in your Journal, we were somewhat surprised to note that Granton Harbour had been omitted from Lists "B" and "D," and that it was treated in the same manner as three extremely small harbours, coupled with Messrs. Wilton and Bell's statement that they had inspected the Scottish Ports which have a coastal trade of importance.

Although not a large harbour, our coastal trade is of some magnitude. The principal coastwise trade consists of a yearly average shipment of about 500,000 tons of coal, largely to London and Aberdeen, while our total foreign trade has a value of about £600,000.

You will therefore appreciate our concern at the impression given in the opening paragraph of the Report, in view of the fact that Granton Harbour was the subject of one of your principal articles in your issue of June, 1935, and that it will celebrate its centenary in the autumn of this year.

We are,
Yours faithfully,
For Granton Harbour, Ltd.,
J. H. HANNAY-THOMPSON (JNR.).
General Superintendent and Engineer.

Granton Harbour, Ltd.,
General Superintendent and Engineer's Office,
Granton, Edinburgh, 5.

To the Editor of the "Dock and Harbour Authority."

27th May, 1937.

Dear Sir,

Harbour of Colchester.

I am desired by the Chairman of the Harbour, etc., Committee to refer to the article on facilities for coastal trade at Ports in England, Wales and Scotland, which appeared in the May Issue of "The Dock and Harbour Authority," and to point out that no mention is made of the Port of Colchester.

The Port is situated on the River Colne and at the Hythe, Colchester, provides 3,790-ft. of private quays, 2,500-ft. of public quays, the depth of water being 12-ft. 6-ins. H.W.O.S.T. and 9-ft. at neap tides drying at low water, with facilities for swinging vessels up to 167-ft.

In 1936 the total tonnage transported on the river was 92,000 inwards and 213,000 outwards, the inward traffic being Grain 31.7 per cent., raw materials for bricks (from Denmark) 24.8 per cent., Coal 22.6 per cent., Petrol 10.2 per cent., Timber 9.2 per cent., and Miscellaneous 1.5 per cent. The export trade Sand and Gravel 98.1 per cent. (from pits on the river bank), and Flour, Oil-cake, etc., 1.9 per cent.

A scheme has been prepared to deepen the river at the Hythe to a depth of 15-ft. at spring tides and 11-ft. 9-ins. at neap tides, and to enlarge the swinging berth to accommodate vessels up to 204-ft. in length.

Yours faithfully,
R. L. H. HISCOTT,
Town Clerk.

Town Hall,
Colchester.

Widening Gibraltar Dry Dock.

It is announced that tenders are being invited for the widening of No. 1 Dry Dock at Gibraltar at an estimated cost of between £350,000 and £500,000. The dock was opened in April, 1906, and is known as the Prince of Wales Dock. It has a length of 852-ft., an entrance width of 93-ft. 8-ins., and a depth of water on sill of 38-ft. 7-ins.